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***Incorporating ESG criteria into Public Valuation: A Systematic
Framework for Comparable Companies Analysis***

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Abstract

Despite a growing interest in integrating Environmental, Social, and Governance (ESG) criteria and extensive research linking robust ESG performance with improved financial results, methodologies for incorporating ESG into public valuation models remain largely qualitative and unsystematic. This thesis addresses the need for quantitative and systematic methods to integrate ESG into financial analysis and presents a framework for incorporating ESG factors into the Comparable Companies valuation method. This is achieved by adjusting baseline EV/EBITDA multiples with a coefficient computed using Moody's ESG scores and min-max standardization.

Our findings demonstrate that integrating and ESG coefficients into valuation multiples provides a more accurate and holistic assessment of a company's value and risk profile, considering both its financial and ESG performances. This research contributes to the field by providing a standardized quantitative approach to ESG integration in valuation models, aiding investors, policymakers, and companies in factoring ESG considerations in their decision-making process.

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1. Introduction

1.1. Objectives of the paper and general approach

In recent years, the integration of Environmental, Social, and Governance (ESG) criteria into public market valuation has gained significant popularity among investors, business valuation specialists, and other stakeholders. This growing emphasis on ESG factors reflects a broader shift towards sustainable and responsible investment practices, driven by the assumption that companies with strong ESG performance are more likely to achieve better financial stability, lower risk, and enhanced long-term value creation (McKinsey, 2023). As investors increasingly prioritize sustainability, the need for reliable and systematic methods to integrate ESG factors into financial valuations becomes paramount.

Existing research has extensively explored the relationship between ESG performance and corporate financial performance. Studies such as those by Friede, Busch, and Bassen (2015) and Alshehhi et al. (2018) have demonstrated a positive correlation between ESG integration and financial outcomes. However, the methodologies for incorporating ESG into valuation models remain predominantly qualitative, often relying on ESG reporting and assessments. This reliance on qualitative methods underscores a significant gap in the existing literature, where a standardized, quantitative approach to ESG integration is lacking. Furthermore, the existing literature that addresses the integration of ESG criteria into traditional valuation methods primarily focuses on the Discounted Cash Flow (DCF) model. While the DCF method is widely used, it is often challenging to implement due to its time-consuming nature and the extensive data collection and assumption-making it requires.

Our research aims to bridge this gap by developing a comprehensive framework for integrating ESG factors into the Comparable Companies valuation method, a simple yet widely used approach. We focused on large-cap companies in European markets, classified into various industry groups. We began by engaging with ESG analysts at Five Arrows Principal Investments to explore methodologies and develop the concept of applying a premium or discount to valuation multiples based on ESG performance. We selected companies within the main industry groups and collected financial metrics from Capital IQ and ESG ratings from Moody's, chosen for their comprehensive coverage and robust methodology. We performed peer group benchmarking and used min-max standardization to normalize ratings, incorporating a scaling factor to adjust for baseline EV/EBITDA multiples. Our approach was applied consistently across sectors, enabling us to analyse the impact of ESG-adjusted multiples on company valuations and provide a comprehensive assessment that reflects both financial and ESG performance.

This study aims to enhance our understanding of if and how ESG criteria can influence company valuations. By focusing on quantitative analysis, we hope to offer a reliable and consistent method for investors to incorporate ESG performance into their investment decisions, providing a practical, easy-to-implement, and systematic framework for integrating these factors into traditional valuation models. We begin this thesis by contextualizing ESG and exploring current trends. We then review the existing literature on the relevance of ESG in corporate operations and the methods for integrating ESG into valuation models. Following this, we detail our research methodology and conclude with a discussion of our findings and their implications.

1.2. What is ESG?

ESG is an acronym for environmental, social and governance that “refers to a set of standards used to measure an organization’s environmental and social impact” (IBM). It’s typically used in the context of investing, although it also pertains to customers, suppliers, employees and the public at large.

1.2.1. Characteristics of ESG

ESG encompasses three key dimensions: Environmental, Social, and Governance.

The environmental dimension addresses a company’s impact on the natural environment. It includes metrics such as energy use, waste management, pollution levels, natural resource conservation, and animal treatment. Companies are assessed on their efforts to mitigate their environmental footprint and manage environmental risks. This includes climate change policies, carbon emissions, water usage, and biodiversity impacts.

The social dimension focuses on the company’s management of its relationships with employees, suppliers, customers, and the communities where it operates. These social criteria include labour practices, diversity and inclusion, human rights, and health and safety standards. These factors assess a company's commitment to ethical practices and social responsibility, focusing on its impact on stakeholders and society at large.

The governance dimension pertains to a company’s leadership, executive compensation, audits, internal controls, and shareholder rights. This dimension evaluates the quality and effectiveness of a company’s governance structure, including board diversity and independence and ethical business practices. Good governance practices ensure that a company is run in a responsible and fair manner, mitigating risks related to management and operations.

ESG scores provided by rating agencies such as Moody's, MSCI, and Bloomberg play a crucial role in assessing these dimensions. The main ESG criteria considered by these organizations are the following:

Pillar	Moody's	MSCI	Bloomberg
Environmental	Carbon transition Physical climate risks Water management Waste and pollution Natural capital	Climate change Natural resources Pollution & waste Environmental opportunities	Carbon emissions Climate change effects Pollution Waste disposal Renewable energy Resource depletion
Social	Customer relations Human capital Demographic and societal trends Health and safety Responsible production	Human capital Product liability Stakeholder Social opportunities	Supply chain Discrimination Political contributions Diversity Human rights Community relations
Governance	Financial strategy and risk management Management credibility and track record Organizational structure Compliance and reporting Board structure and policies	Corporate governance Corporate behaviour	Cumulative voting Executive compensation Shareholders' rights Takeover defence Staggered boards Independent directors

1.2.2. Types of ESG integration

There has been a growing focus from investors, business valuation specialists and other stakeholders on ESG factors in recent years, driven by the increasing importance of Socially Responsible Investing (SRI). An increasing number of investment professionals are now actively looking to integrate ESG strategies into their investment processes. Indeed, a study conducted by Deutsche Bank found that 75% of surveyed investors have already incorporated ESG considerations into their investment decision-making, but the

weight of these considerations in the decision-making process varies greatly depending on the strategy used by investors.

There are four main strategies to integrate ESG into investments:

Exclusionary screening, the first and most widely used strategy, involves excluding companies or sectors from investment portfolios based on certain ESG criteria. Common exclusions include industries such as tobacco, fossil fuels, and weapons. This strategy aims to avoid investing in companies perceived to have negative environmental or social impacts. According to the same Deutsche Bank study, 18% of European surveyed investors defined their ESG investment strategy as the exclusion of sensitive sectors, compared to 15% for best-in-class investing and 6% for impact investing.

Best-in-class investing involves selecting companies that lead their industry in ESG performance. Investors using this approach prioritize companies with the highest ESG ratings within a specific sector, rewarding those that demonstrate superior sustainability practices.

Thematic investing focuses on specific ESG themes, such as clean energy, water management, or social equality. This strategy allows investors to target areas of interest or concern, channelling capital towards sectors or companies that are making significant impacts in those areas. For example, renewable energy funds are a popular theme that attracts investors interested in supporting the transition from fossil fuels to a low-carbon economy (Sustainable Investing: Revolutions in Theory and Practice, 2018).

Impact investing, a strategy that has gained considerable traction in recent years, is characterized by “investments made with the intention of generating positive, measurable, social, and environmental impacts alongside financial returns” (GIIN, 2023). This approach directs capital to projects and companies that aim to address specific social or environmental issues. It is the strategy that has the most potential to drive substantial changes as it implies investing in solutions that will foster sustainable development.

However, all these strategies integrate ESG factors qualitatively, typically through ESG reporting. In their ESG global survey (2023), BNP Paribas found that 39% of surveyed investors integrated ESG factors into their existing financial reports in the form of ESG reporting.

Given that investors are concerned with financial returns and performance, our thesis aims to bridge this gap by integrating ESG into valuation methods quantitatively. By focusing on quantitative analysis, we seek to offer a systematic and measurable approach to understanding the financial implications of ESG performance, thereby enhancing the reliability and consistency of ESG-related financial analysis.

1.2.3. Types of ESG materiality

As previously stated, most European investors who consider ESG factors into their investment process, do so through ESG reporting. The investors who choose to incorporate ESG reporting must abide by the European Sustainability Reporting Standards (ESRS) which recently required materiality assessments in reporting practices of nearly 50,000 of EU companies (Workiva, 2023).

Materiality is a crucial concept that determines the significance and relevance of specific issues or information within a company or business sector (SABS, 2020). Fundamentally, materiality is an accounting principle that determines which information is useful for decision-making. Materiality assessment processes are frequently utilized by companies to pinpoint issues that reflect a company's social and environmental impacts. These processes also provide valuable information that helps stakeholder and strategic decision-making (Quentic, 2024).

According to the European Financial Reporting Advisory Group (EFRAG), materiality operates as a dual concept, known as "double materiality," which includes "Financial materiality" and "Environmental & Social materiality". Financial materiality relates to any ESG factors that could have a real-world impact on a company's financial performance. Essentially, this aspect of materiality assesses what elements of ESG could significantly influence an organization's financial outcomes. Environmental & Social materiality, on the other hand, considers the current and potential future adverse impacts of a company on the environment, society, and people (EFRAG, 2023).

In essence, the concept of double materiality revolves around two key aspects: firstly, the magnitude of ESG issues on an organization's operations; and secondly, the material impact that an organization's actions can have on ESG issues (Quentic, 2024).

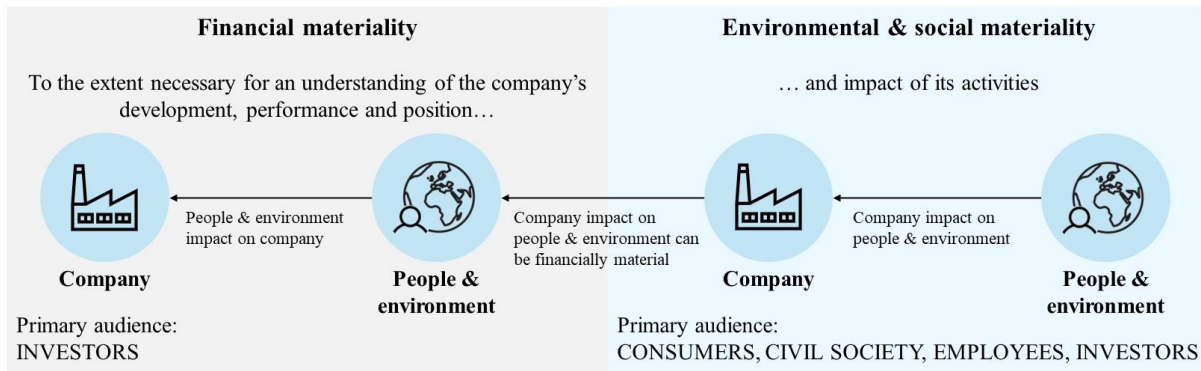


Figure 1.1: A Visual Representation of Double Materiality (EFRAG)

A double materiality assessment is “a thorough evaluation that helps organizations identify sustainability and ESG issues that are crucial to both their operations and their stakeholders” (SASB, 2020). This assessment is crucial in shaping a company’s ESG strategy and determining the prioritization of its initiatives. It requires an in-depth examination of the company’s activities, including those occurring within its value chain—both upstream and downstream (SASB, 2020).

Historically, companies have assessed the materiality of sustainability matters separately from financial information, rarely connecting these two concepts or their practical applications. This laid the groundwork for the recent integration of double materiality into regulatory frameworks, specifically the Corporate Sustainability Reporting Directive (CSRD). The rationale behind this rigorous reporting criterion is to promote a culture of accountability among corporations. By enforcing higher standards of transparency, businesses are expected to take their ESG commitments more seriously and are encouraged to actively pursue transitions towards achieving net-zero emissions (Quentic, 2024).

Double materiality is also crucial for our analysis, as identifying the most material issues for both the company and its stakeholders allows for their respective interests to be reflected in the company’s valuation. By considering the dual impact of ESG factors, organizations can develop strategies that align with broader sustainability goals while enhancing their operational and financial performance.

1.3. Measurement and reporting standards

As the integration of ESG factors into investment processes and corporate strategies becomes increasingly popular, robust measurement and reporting standards are needed. In Europe, various frameworks and regulations have been developed to ensure consistency, transparency, and accountability.

The Global Reporting Initiative (GRI) provides comprehensive guidelines for companies to report on their economic, environmental, and social impacts.

The Sustainability Accounting Standards Board (SASB) focuses on disclosing “financially material sustainability information to investors”. SASB standards are industry-specific and align sustainability reporting with traditional financial reporting (SASB, 2018).

The Task Force on Climate-related Financial Disclosures (TCFD), a critical component of the International Sustainability Standards Board (ISSB), encourages companies to disclose information on governance,

strategy, risk management, and metrics related to climate change. The TCFD framework is widely endorsed and integrated into European regulatory requirements, enhancing transparency regarding climate-related risks and opportunities (TCFD, 2017).

The European Union has introduced several regulations to standardize ESG reporting and promote sustainable finance. The Non-Financial Reporting Directive (NFRD) mandates that large public-interest companies disclose information on their strategies for addressing social and environmental challenges. The aim is to increase transparency and encourage sustainable practices (European Commission, 2014). Building on this, the CSRD expands the scope and requirements for non-financial reporting, standardizing ESG disclosures and requiring large companies to disclose how they manage social and environmental challenges (European Commission, 2023). Similarly, the Sustainable Finance Disclosure Regulation (SFDR) mandates financial market participants to share ESG-related information on their investment products to foster market transparency and prevent greenwashing (ESMA, 2023).

Additionally, the EU Taxonomy Regulation establishes criteria for defining environmentally sustainable economic activities, guiding investment flows towards projects and activities that support sustainability (European Commission, 2020).

Complementing these regulations, the Principles for Responsible Investment (PRI) is an international network of investors dedicated to incorporating ESG factors into their investment decisions. PRI offers a framework for integrating ESG considerations across various asset classes and investment strategies (Principles for Responsible Investment, 2006).

These standards form the backbone of ESG integration in Europe, providing a structured approach for companies and investors to assess and disclose ESG information. This harmonization enhances the reliability of ESG-related financial analysis, which is crucial for our thesis's focus on quantitatively integrating ESG into valuation methods

1.4. Importance of ESG criteria within companies

1.4.1. Market trends & investor demand

In recent years, the integration of ESG criteria into investment strategies has seen significant growth, driven by evolving market trends and heightened investor demand. As ESG considerations become more mainstream, understanding these trends and the underlying investor motivations is crucial for effectively incorporating ESG into public market valuations.

A substantial shift has been observed in the investment community towards prioritizing ESG factors. According to a survey by PwC, a significant portion of investors now regard ESG issues as central to their investment decisions, with climate change identified as a crucial factor by more than half of the respondents (PwC, 2023). This shift indicates that investors are not only focusing on financial returns but are also increasingly concerned about the broader impact of their investments on society and the environment (Nasdaq, 2023).

The market has responded to this growing demand by creating a variety of ESG-focused financial products. Bloomberg Intelligence projects that ESG assets could reach \$53 trillion by 2025, comprising more than a third of global assets under management. This surge is fuelled by products such as green bonds, social bonds, and sustainability-linked loans, which provide companies with access to a diverse investor base and potentially more favourable financing terms (Bloomberg Intelligence, 2021).

Investor expectations are also driving significant regulatory developments in Europe to enhance ESG transparency and accountability. As previously stated, some of the most important ones are the CSRD, SFDR and EU Taxonomy regulations.

Despite the integration of ESG strategies, challenges like greenwashing and the need for robust data standards persist. Investors and companies are addressing these by enhancing ESG frameworks and adopting stringent reporting practices. MSCI predicts continued emphasis on regulatory compliance, supply chain innovations, and advancements in ESG data quality and reporting in the coming years (MSCI, 2023).

As demand for ESG integration continues to grow, the role of ESG in investment decisions will become increasingly critical. This underscores the necessity for robust ESG practices, transparent reporting, and the development of a solid framework to quantitatively integrate ESG factors into valuation models.

1.4.2. Stakeholder expectations and influence

Stakeholder expectations play a pivotal role in shaping the ESG practices of companies. As awareness of ESG issues grows, stakeholders including investors, customers, employees, and regulators increasingly demand transparency, accountability, and responsible behaviour from corporations.

Investors are among the most influential stakeholders, driving the adoption of ESG criteria through their investment decisions and engagement with companies. According to a survey by PwC, 79% of investors

believe that ESG risks are important in investment decision-making, and 70% say they are more likely to divest from companies with poor ESG performance (PwC, 2023). The main reason investors are pushing for the adoption of ESG criteria is because their clients are asking them to do so (Deutsche Bank, 2021). Indeed, according to Deutsche Bank's 2021 ESG survey, 63% of investor respondents stated that their main motivation to incorporate ESG criteria into their investment strategy is because of client demand.

This also suggests that consumers are also becoming more conscious of the ethical and environmental implications of their purchases. A survey conducted by Cone Communications found that 87% of consumers "will purchase a product because a company advocated for an issue they care about", while 76% will refrain from making a purchase if they discover that the company supports an issue contrary to their convictions (Cone Communications, 2017). Companies are thus incentivized to adopt robust ESG practices to align with customer values, build brand loyalty, and differentiate themselves in the market.

Incorporating ESG criteria into corporate strategies is not only a response to market trends and investor demand but also a critical factor in meeting stakeholder expectations. By aligning with the values and demands of investors, customers, employees, regulators, and communities, companies can enhance their reputation, achieve long-term sustainability, and create value for all stakeholders.

Despite the growing body of evidence demonstrating the benefits of integrating ESG into financial analysis, there is a notable gap in quantitative methodologies for incorporating ESG factors into public valuations. The following research aims to address the current deficiencies in existing valuation practices by developing a comprehensive, systematic, and standardized framework for factoring ESG in Comparable Companies valuation.

How can ESG criteria be quantitatively integrated into public valuations to provide a more comprehensive assessment of company value?

2. Literature review

2.1. The relevance of ESG in business valuation

The 2022 Global Sustainable Investment Review (GSIR) reported that sustainable investment assets in major markets, including Europe, the US, Japan, Canada, and New Zealand, reached \$30.3 trillion, reflecting a 20% increase from 2016 to 2022. This influx of capital demonstrates the growing emphasis on supporting sustainable practices worldwide (Yoon et al., 2018). Companies that incorporate ESG principles into their business strategies often experience significant benefits, while those that neglect these considerations risk compromising their long-term sustainability. But how exactly does ESG contribute to business performance and value creation?

2.1.1. ESG, firm value, and profitability

Research has extensively explored the impact of ESG factors on firm value and profitability. Friede, Busch, and Bassen (2015) highlight that academic interest in the relationship between ESG standards and corporate financial performance dates to the 1970s. Their comprehensive review of over 2200 studies concludes that substantial evidence supports the positive influence of ESG integration on financial outcomes, with approximately 90% of the studies demonstrating a favourable correlation – although it's important to note that not all these studies are of high quality.

Additionally, Alshehhi et al. (2018) conducted a meta-analysis of 132 papers published in journals, finding that 78% of these studies identified a positive relationship between sustainability practices and financial performance. These findings collectively validate the financial benefits of ESG investing and underscore the importance of sustainable practices in enhancing corporate performance.

Several multi-country studies have also identified a positive correlation between ESG scores and a firm's financial performance. In their study, Bhaskaran et al. (2020) explored the impact of ESG on the financial performance of 4,887 firms between 2014 and 2018, using firm value (Tobin's Q) and operational performance indicators (Return on Equity, ROE, and Return on Asset, ROA). They found that companies excelling in environmental, social, and governance aspects tend to create more market value. Similarly, De Lucia et al. (2020) analysed 1,038 public companies from 22 European countries between 2018 and 2019, discovering a positive relationship between ESG factors (employment productivity, environmental innovation, diversity & opportunity) and financial performance (ROE and ROA). For instance, the study

discovered that promoting diversity and equal opportunities enabled companies to allocate their resources more effectively, fostering a multicultural workplace that enhanced employee productivity and led to above-average business performance.

In those studies, researchers found that the positive influence of ESG on financial performance at the corporate level is due to mediating factors in their sustainability strategies such as increased innovation, enhanced operational efficiency, improved risk management, and more. These factors are defined by the Return on Sustainability Investment (ROSI) framework proposed by Atz et al. (2019).

The common thread among these studies is that they consistently highlight how strong ESG performance within companies provides significant downside protection, particularly during periods of social or economic instability. Implementing robust ESG practices helps companies mitigate reputational and regulatory risks, because these initiatives foster improved risk management and drive innovation within firms. Moreover, the benefits of ESG on financial performance tend to be more pronounced over the long term, suggesting that the positive impacts of sustainability initiatives become increasingly evident as time goes on.

However, the issue of the compatibility between ESG standards and financial success remains an ongoing discussion.

Despite numerous positive examples of the ESG-financial performance relation, researchers often contend that the findings are ambiguous, inconclusive, or conflicting (Griffin and Mahon 1997; Rowley and Berman 2000; Hoepner and McMillan 2009; Revelli and Viviani 2015, as cited in Friede, Busch, & Bassen, 2015). There is ongoing debate among scholars and practitioners regarding the overall impact of this phenomenon, including its measurability and durability (Barnett 2007; Devinney 2009; Wood 2010; Orlitzky 2011; Borgers et al. 2013, as cited in Friede, Busch, & Bassen, 2015).

Several studies have found evidence of a negative relationship between ESG performance and firm value in various countries. Based on Barnett's (2007) research, it can be inferred that investing in ESG initiatives may potentially have a detrimental effect on a company's financial performance. This is because funds are redirected towards other stakeholders, rather than solely benefiting shareholders. In a study conducted by Brammer et al. (2006), the authors examined the influence of corporate social performance on firms in the UK. By analysing market returns, they discovered that firms with lower social scores outperformed the market.

As cited in Friede, Busch & Bassen (2015)¹, Landi and Sciarelli (2019), conducted a study on 54 listed Italian companies from 2007 to 2015, analysing the relationship between their ESG scores and financial performance. Their findings indicate a negative correlation between the two factors. Similarly, in their analysis, Folger-Laronde et al. (2020) examine the correlation between ESG ratings and financial returns of ETFs (Exchange Traded Funds) in Canada during the Covid-19 pandemic. The study finds that even ETFs with strong ESG performance may not provide sufficient protection during a severe market downturn.

Another set of studies have explored the impact of ESG performance on financial returns and found mixed results. Saygili et al. (2021) examined Turkish companies from 2007 to 2017, finding that environmental reporting negatively affected financial performance, while stakeholder participation in social aspects and governance had positive effects. Giannopoulos et al. (2022) studied Norwegian firms from 2010 to 2019, revealing a positive correlation between ESG scores and firm value (Tobin's Q) but a negative correlation with profitability (ROA). Behl et al. (2022) found mixed results in the Indian energy sector regarding ESG reporting and firm value. Lopez-de-Silanes et al. (2020) in their multi-country study found that ESG scores had no impact on financial performance.

Whelan et al. (2021) reviewed over 1,000 studies from 2015 to 2020 on the relationship between ESG and financial performance (defined by ROE, ROA or stock price as metrics). They found that 21% had mixed results (i.e., the same study finding a positive, negative or neutral relationship), 8% showed a negative relationship. Investment studies commonly focused on risk-adjusted attributes such as alpha or the Sharpe ratio, and 59% concluded similar or better performance compared to conventional investments, while only 14% found negative results (Whelan et al., 2021).

While the relationship between ESG factors and financial performance is well-documented, the role of ESG in risk management is equally critical. Studies indicate that ESG practices can both mitigate and, in some cases, introduce new risks. To fully understand ESG's impact on firm stability and investor security, it is essential to explore how these factors influence systematic and firm-specific risks.

2.1.2. ESG impact on risks

Understanding and managing risk is essential for the survival and success of businesses. Unlike uncertainty, which is unpredictable, risk refers to events that can be anticipated and statistically calculated (Karwowski & Raulinajtys-Grzybek, 2021). In this context, the concept of risk revolves around the likelihood of an

¹All of the studies cited in those two paragraphs have been referenced from Friede, Busch and Bassen's 2015 study

action or inaction resulting in a loss. Within the financial literature, risk is defined as “unforeseen events that can cause fluctuations in a company's debts or assets” (Daniel-Vasconcelos, de Souza Ribeiro, & Lima, 2021). There are two types of risks: idiosyncratic, which are firm-specific risks that can be eliminated through diversification, and systematic, which are market risks (Brealey & Myers, 2000 as cited in Daniel-Vasconcelos, de Souza Ribeiro, & Lima, 2021).

- **ESG and systematic risk**

Systematic risk, also known as market risk or undiversifiable risk, refers to the risk inherent to the entire market or a particular segment of the market. This type of risk affects all investments across the board and cannot be mitigated through diversification. Examples include economic recessions, political instability, changes in interest rates, and natural disasters (Investopedia).

Under the capital-asset pricing model (CAPM), the expected return of an asset is determined by its sensitivity to systematic risk, as measured by beta. Firm-specific risk, i.e., risks specific to individual companies, can be mitigated through diversification. Therefore, diversified investors will rationally focus on systematic risk (Giese et al., 2019).

ESG risks are usually grouped into four categories: physical risks, transition risks, reputational risks, and operational risks. Physical and transition risks can be classified as systematic risks.

Physical risks stem from the direct impacts of climate change, which can disrupt business operations and supply chains, leading to significant financial losses (IPCC, 2018). Indeed, climate change represents a significant systematic risk due to its potential to disrupt economies and industries worldwide. Increasing temperatures, extreme weather, and rising sea levels affect agricultural productivity, infrastructure, and public health, leading to broader economic instability.

Transition risk is associated with the transition to a low-carbon economy and includes regulatory changes, technological advancements, and market dynamics that can have an impact on a company's financial performance and competitive positioning. It can be considered as another layer of systematic risk as it involves the potential for stranded assets, where investments in fossil fuels become obsolete. This transition demands substantial capital expenditure on new technologies and infrastructure. Companies in the coal industry, for example, have faced declining demand and increased regulatory pressures as the global energy landscape shifts towards renewable sources. The bankruptcy of Peabody Energy in 2016 illustrates how transition risks can undermine financial stability (IEA, 2017). Businesses must strategically manage these transition risks to navigate the shift towards sustainable energy sources effectively.

In addition to those two risks, strict environmental regulations aimed at reducing carbon emissions and promoting sustainability can impose significant financial burdens on companies, particularly those in energy-intensive industries. The European Union's Emissions Trading System (EU ETS), for example, sets limits on greenhouse gas emissions for over 11,000 installations. Companies that fail to comply with these regulations face significant fines, which can adversely affect their profitability and market position (European Commission, 2020). These regulatory pressures necessitate proactive strategies to comply with environmental standards while maintaining financial performance.

Health crises, such as pandemics, also exemplify how global health issues can rapidly escalate into systematic risks. The COVID-19 pandemic in 2020 caused widespread economic downturns, massive supply chain disruptions, and significant impacts on industries such as travel, hospitality, and retail. The pandemic underscored the importance of integrating health-related ESG factors into business continuity planning to enhance resilience against similar future crises (World Bank, 2020).

While relatively few studies have explicitly examined the relationship between ESG and systematic risk², some research put into evidence that strong ESG practices are associated with mitigating these risks.

For instance, Serafeim (2015) found that the effective integration and disclosure of financial information along with environmental, social, and governance practices can help mitigate systematic risks faced by companies. Similarly, Samet et al. (2017) suggest that disclosing social responsibility information reduces information asymmetry, thereby enhancing the accuracy of predictions related to a company's future revenue, costs, performance, and risks. These improved transparency and accountability can contribute significantly to managing and reducing systematic risk.

Moreover, companies with strong ESG practices often experience less volatility in their stock prices (Friede, Busch, & Bassen, 2015). This stability is attributed to better management and robust risk management practices, which buffer against market-wide shocks. For example, sustainable companies are more likely to adopt practices that reduce their environmental impact, thereby mitigating risks related to regulatory changes and environmental liabilities (Friede, Busch, & Bassen, 2015).

Additionally, firms that prioritize environmental sustainability often reduce waste and energy consumption, leading to cost savings and more stable profit margins. These efficiencies help firms better withstand economic downturns and other systematic risks (Eccles, Ioannou, & Serafeim, 2014). Companies with high

² Most studies have investigated the relationship between Corporate Social Responsibility and systematic risk – which is not the same as ESG

ESG scores are typically better at managing social and governance issues. For example, companies with strong labour practices can avoid strikes and other labour-related disruptions, while those with robust governance practices are less likely to encounter scandals or legal issues. These factors collectively reduce the firm's exposure to systematic risk (Giese et al. 2019).

However, Sassen et al. (2016) conducted a study using a large panel data set of European companies to investigate the influence of Corporate Social Performance (measured by attention to ESG factors) on market-based risk. Their findings revealed a considerable negative correlation: while environmental performance often decreases idiosyncratic risk, total risk and systematic risk are only affected in businesses which operations are more sensitive to the environment (i.e. Agriculture, Energy).

Although more studies put into light the link between ESG integration and reduction in systematic risk, not all companies consistently adopt these practices. One of the main reasons for this is the significant upfront costs associated with implementing ESG practices, which include investments in new technologies, restructuring operations, and comprehensive reporting. Many corporations, especially smaller ones, may find these initial costs prohibitive despite potential long-term benefits (Friede, Busch, & Bassen, 2015). The lack of standardization between rating agencies, and different criteria use can also discourage firms from fully committing to ESG practices (Clément, Robinot, & Trespeuch, 2023).

- **ESG and firm-specific risk**

Reputational and operational risks are additional ESG concerns that can be classified as firm specific. Indeed, reputational risks involve the potential damage to a company's public image and stakeholder relationships due to perceived negative environmental or social practices. Companies that fail to address ESG concerns may face consumer boycotts, negative media coverage, and loss of investor confidence (Eccles, Ioannou, & Serafeim, 2014). Lastly, operational risks pertain to the impact of environmental and social factors on a company's day-to-day activities. This includes supply chain disruptions, resource scarcity, and workforce issues, which can hinder productivity and increase costs (Whelan & Fink, 2016). Understanding and mitigating these diverse risks are essential for maintaining long-term sustainability and resilience in the evolving business landscape.

Having access to enterprise resources is essential for a company to effectively handle uncertainties in production and operations and minimize risks (Tan et al., 2022). A strong ESG performance can greatly benefit a company by ensuring it has the necessary resources to navigate and mitigate risks effectively.

First and foremost, sustainable development theory suggests that companies that excel in ESG aspects prioritize business standardization and long-term sustainability. The company's emphasis on sustainable development can appeal to consumers and suppliers who value long-term thinking, enabling the company to avoid short-sighted actions and mitigate risks effectively (Chen, 2022).

Additionally, according to stakeholder theory, companies can improve their public image and build moral and reputational capital by actively fulfilling their ESG responsibilities. In their study, Hassan et al. (2021) examined the correlation between ESG scores and firm risk among 4624 non-financial firms from different regions such as Africa, Asia, Europe, Latin America, North America, and Oceania. Their research suggests that companies with higher ESG scores tend to have reduced firm-specific and systematic risks. This relationship highlights the significance of ESG factors in minimizing overall risk exposure for companies, supporting the stakeholder theory that emphasizes the risk reduction advantages of robust ESG performance.

Thirdly, according to asymmetric information theory, companies with strong social responsibility performance can convey their production and operational status to market investors through the disclosure of non-financial information, such as ESG factors. This increased transparency (Brammer et al., 2006; Pedersen et al., 2021) reduces information asymmetry, enhances the company's ability to access credit in capital markets, and mitigates risks related to funding shortages.

Furthermore, as per the theory of asymmetric information, companies that prioritize social responsibility can effectively communicate their production and operational status to investors by disclosing non-financial information, such as ESG factors. This enhanced transparency (Brammer et al., 2006; Pedersen et al., 2021) helps to reduce information asymmetry, making it easier for the company to obtain credit in capital markets and reducing the risks associated with funding shortages.

Lastly, following ESG standards helps companies operate within legal frameworks, which enhances their legitimacy and earns the trust and support of government and regulatory authorities. Adhering to regulations not only helps companies avoid future regulatory pressures and violations (Reber et al., 2022), but also enables them to secure important resources like government subsidies, which in turn reduces risks for the firm.

However, some researchers in the field of neoclassical economics have put forth theoretical arguments suggesting that sustainability investments can potentially increase a firm's costs, putting them at a competitive disadvantage compared to their rivals (Friedman, 1970; Aupperle et al., 1985; McWilliams and

Siegel, 1997; Jensen, 2002, as cited in Khan et al. 2015). Other studies have found that the impact of ESG performance on firm risk may be heterogeneous due to differences in the nature of the enterprise. Fernandez-Feijoo et al. (2014) and Zhao et al. (2018) discussed the heterogeneity of the impact of ESG performance on company risk by business size. Indeed, company size is a key indicator of corporate resources. Small enterprises face resource limits and disadvantages compared to large firms. Although, enhancing non-financial information like environment, social responsibility, and corporate governance might assist small enterprises broaden resources, they often face significant upfront costs when implementing these. These costs can be disproportionately high compared to their smaller revenue bases, potentially reducing the incentive to implement them (Barnett & Salomon, 2012).

Additionally, publicly listed companies frequently encounter pressure from shareholders to achieve immediate financial results. This focus on quarterly earnings can conflict with the longer-term perspective required for effective ESG implementation. Managers may therefore prioritize immediate financial performance over long-term sustainability initiatives – this bias is called managerial myopia (Eccles, Ioannou, & Serafeim, 2014).

Therefore, do sustainability investments truly play a crucial role in mitigating risk and increasing value for shareholders? As seen, several studies have explored this question, but the findings have been mixed. One possible explanation for the conflicting results is that previous research has not differentiated between material and immaterial sustainability issues.

According to Khan et al. (2015), investments in immaterial ESG issues are less likely to enhance value compared to investments in material issues. Their research suggests that companies excelling in ESG material issues tend to outperform those that perform poorly in those issues, aligning with the notion that investments in material topics can enhance shareholder value. Conversely, companies that excel in immaterial sustainability topics do not necessarily outperform companies that perform poorly in these areas. Considering this, we will explore the link between ESG and materiality as a foundation for incorporating ESG criteria into valuation.

2.1.3. ESG and materiality

Assessing ESG materiality is the initial step in integrating them into the valuation model. Indeed, in their research, Friede, Busch, and Bassen (2015) found that the positive impact of ESG factors on corporate value and financial performance is stronger when ESG concerns are material to the company's core operations.

As explained in JLL's "Unlocking ESG Opportunities" report, defining material ESG factors is crucial for justifying associated modifications and preventing ambiguity due to the subjective nature of ESG considerations and adjustments. Meanwhile, the materiality of certain ESG criteria may be industry-specific or company-specific and should be examined on a case-by-case basis. Materiality is determined by evaluating the likelihood and magnitude of impact. According to the CFA Institute, non-material ESG elements have no impact on financials or valuations. Some circumstances will have a long-term financial influence, whether positive or negative. Thus, materiality assessment is critical when factoring ESG concerns into corporate value (JLL, 2022).

In 2016, W. Schramade introduced the Value-Driver Adjustment (VDA) approach, emphasizing the significance of materiality from an investor's perspective. From an investment standpoint, materiality refers to an issue that has the potential to significantly impact a company's value drivers and valuation. These materiality issues differ between industries and even within industries. According to a recent Harvard Business School paper (Khan et al. 2015), companies that excel at their most material ESG issues outperform the market. In contrast, it discovers that firms that score high on immaterial issues underperform.

To overcome this issue, Schramade's VDA approach factors ESG criteria with traditional valuation models. It does so by linking these criteria to key value drivers. By doing so, it takes into account their impact on business models and competitive positions. The main idea is that when a company has a competitive advantage based on ESG factors, it should be reflected in the factors that drive its value. These factors can include increased sales growth, improved profit margins, better use of capital, or reduced risk. These factors directly affect the company's return on invested capital (ROIC) and overall valuation. Schramade and his team use a method where they measure the impact of important ESG factors on the value drivers DCF analysis. By using this method, the average impact of ESG factors can be reflected on the target price in a systematic way, which helps to ensure a sound approach.

In 2014, Schramade and his team used the VDA framework for 127 investment cases. In more than half of these cases, the analysis showed a net VDA, which caused a change in the target price. Among all the changes, 39% had a positive impact while 13% had a negative impact. The adjustments to the target price ranged from a decrease of 23% to an increase of 71%. Profit margins were the most adjusted value driver, accounting for 46% of all cases. Sales growth was adjusted in 35% of cases, while the cost of capital was adjusted in 13% of cases. This approach ensures that the impact of ESG factors is accurately quantified when assessing projected performance. This, in turn, influences target prices and investment recommendations.

This approach ensures that the effects of the most material ESG factors are accurately reflected in projected performance, influencing target prices and investment recommendations.

2.1.4. ESG integration in valuation

The notion of ESG integration is often described so broadly that it may lose some of its sense. A growing number of asset managers assert that they consider ESG factors in their investment processes. These investment professionals are typically signatories of initiatives like the UNPRI and are actively involved in voting and engagement activities. Throughout the investment process, they usually employ dedicated ESG staff and apply screening and exclusion criteria (Schramade, 2016). Nevertheless, genuine ESG integration extends beyond these practices. The European Sustainable Investment Forum (Eurosif, 2012) provides a more precise definition of ESG integration: “This type (of strategy) covers explicit consideration of ESG factors alongside financial factors in the mainstream analysis of investments. The integration process prioritizes the examination of the ESG issues and their potential influence on a company’s financials (positive and negative), which in turn may affect the investment decision”.

This approach goes well beyond simple screening and engagement, requiring the incorporation of ESG information at every stage of the investment process, from the initial investment case to the valuation models used in decision-making. Only a small number of asset managers fully implement this comprehensive integration. To bridge the gap between these distinct domains, ESG analysts must focus on the most material factors and establish a precise systematic framework for integrating ESG considerations into their models and investment decisions.

We have examined the current body of research on existing frameworks that integrate ESG criteria, and we have retained and identified the following two generally accepted valuation methodologies: the income approach and the market approach.

2.2. Income approach

The Income approach, also referred to as the discounted cash flow (DCF) model, values a business by computing the sum of the present values of its expected future cash flows. This method highly relies on the hypotheses regarding the projected cash flows and the discount rate used, which can be derived from the asset's risk profile and the broader market conditions (Damodaran, 2002). In the DCF model, accurately

determining future cash flows is essential, and the discount rate plays a pivotal role in reflecting the company's long-term cost of capital.

The DCF method is primarily used in traditional valuation methods due to its precise and comprehensive character, which provides a clear picture of an asset's worth based on its ability to create future earnings (Damodaran, 2002). The process presents significant challenges, including the requirement for accurate and dependable projections, which can be difficult to obtain, and the sensitivity of the valuation to the chosen discount rate (Damodaran, 2002).

2.2.1. ESG and expected future cashflows

When including ESG aspects into financial forecasting using the DCF model, accurately measuring the financial effects in line with other valuation drivers is becoming more and more crucial (JLL,2022). A particular way to consider the significance of ESG factors is to modify Unlevered Free Cashflow (UFCF).

As a reminder, the formula for the UFCF formula is:

$$UFCF = EBIT - taxes + non - cash charges - CAPEX - Change in net working capital$$

McKinsey has highlighted five ways in which ESG factors can positively impact a company's cash flows, providing a valuable framework for evaluating ESG's impact. They are the following:

	Strong ESG proposition (examples)	Weak ESG proposition (examples)
Top-line growth	<ul style="list-style-type: none"> - Promote sustainable products to B2B and B2C clients. - Improve access to resources through greater community and government relations 	<ul style="list-style-type: none"> - Lose clients because of poor sustainability practices (e.g., human rights, supply chain) or a perception of unsustainable / dangerous products. - Lose access to resources (including shutdowns) as a result of bad labour relations.
Cost reductions	<ul style="list-style-type: none"> - Reduce energy usage - Reduce water use 	<ul style="list-style-type: none"> - Produce unnecessary waste and incur greater waste-disposal costs
Legal and regulatory interventions	<ul style="list-style-type: none"> - Gain strategic freedom through deregulation - Receive government subsidies 	<ul style="list-style-type: none"> - Suffer restrictions on advertising and point of sale - Incur fines, penalties and enforcement actions

Productivity uplift	<ul style="list-style-type: none"> - Increase employee motivation - Improve social credibility to attract talent 	<ul style="list-style-type: none"> - Deal with “social stigma” which limits talent pool - Lose talent due to weak purpose
Investment and asset optimization	<ul style="list-style-type: none"> - Maximize investment returns by allocating capital for long-term goals, such as sustainable plant and equipment - Avoid investments that may not yield returns due to long-term environmental difficulties 	<ul style="list-style-type: none"> - Premature write-downs might result in stranded assets

Table extracted from PKF (2024)

To further comprehend how ESG features affect valuation and specifically cashflows, Giese et al. (2019) examined a conventional DCF model and identified three important transmission routes. Through assessment of the cashflow channel, businesses with strong ESG profiles are more profitable and dividend-paying because they use their resources more wisely, develop their human capital, and manage innovation better. The second transmission channel, the idiosyncratic channel, put into evidence that strong ESG practices enhance risk management and lower firm-specific risks, leading to fewer severe occurrences and reduced idiosyncratic tail risks. Lastly, according to the valuation channel, linked to the discount rate, companies with robust ESG profiles are less sensitive to systematic market risks. This reduces the company’s overall risk profile, leading to a lower cost of capital as per the CAPM and therefore resulting in higher valuations. Hence, businesses with high ESG ratings enjoy reduced cost of capital and enhanced long-term financial stability.

2.2.2. ESG and the discount rate

In the income approach, incorporating ESG-related risks into the discount rate is another common approach, in addition to modifying the estimated free cashflows. Indeed, when applying the DCF model, projected cash flows are discounted to their present value. The discount rate used, often the weighted average cost of capital (WACC), reflects the risk compensation for equity and debt investors (JLL, 2022). According to the risk-return hypothesis, a higher return corresponds to a larger risk. According to Giese et al., firms with strong ESG profiles are less vulnerable to market shocks, resulting in lower systematic risk, a lower beta, a lower total cost of capital, and higher firm value. In the WACC computation, ESG risks can be included into either the cost of equity or the cost of debt.

- **ESG adjustments through the cost of equity**

Both systematic risks and sector-specific risks need to be factored into pricing. The CAPM framework addresses this through expected market return and beta. As a reminder, the CAPM formula is the following:

$$CAPM = R_f + \beta_i(ER_m - R_f)$$

Where:

R_f = Risk-free rate

β_i = Beta of the investment

$(ER_m - R_f)$ = Market Risk premium

Because market expectations automatically modify the expected market return when ESG issues have an impact on the global economy, the needed rate of return for equity under the CAPM is primarily defined by the asset's sensitivity to the market risk reflected by the beta (JLL, 2022). For example, sectors sensitive to specific ESG issues, like energy-intensive industries to carbon emissions, would experience increased beta volatility.

In that regard, Zerbib's Sustainable CAPM (SCAPM) incorporates ESG factors into beta calculations by considering investor preferences for socially responsible companies. This model works effectively in a non-homogeneous market and, when applied to US equities from 1999-2019, demonstrated an average exclusionary effect of 3% for sin stocks (companies involved in unethical activities like tobacco, alcohol, or gambling). Additionally, Petersen, Fitzgibbons, and Pomorski (2021) developed an ESG-efficient frontier and an ESG-adjusted CAPM based on Markowitz theory, introducing an ESG score optimization constraint (Rödl & Partner, 2024). Their tests on S&P 500 stocks revealed a sin premium, showing a negative alpha estimate, indicating these stocks tend to underperform when ESG factors are considered.

ESG factors can also be integrated into peer group selection for beta determination by including ESG criteria such as a company's ESG rating or CO2 emissions. This method captures ESG-related risks and sector-specific differences that are often less quantifiable (Rödl & Partner, 2024).

- **ESG adjustments through the cost of debt**

ESG factors can also have an impact on the cost of debt for companies. In many cases, sustainable companies tend to have lower costs of debt because of their stability and resilience. These companies enjoy advantages such as better financing options, which include lower interest rates and reduced credit and default spreads (Chava, 2014). For example, in its research “Environmental Externalities and Cost of Capital”, Chava

(2014) discovered that companies facing significant environmental issues have to pay interest rates on loans that are nearly 20% higher than those of their peers. The issuance of green or social bonds, which are tied to environmental or sustainability goals, can also further reduce financing costs for these firms (MSCI).

This focus on ESG helps to lower financing costs. Some lenders include ESG margin ratchets in loan agreements. According to Lodh (2020), as cited in the MSCI's research on ESG and the cost of capital (2020), there is an estimated difference of about 0.75 percentage points in the cost of debt between high and low ESG-rated companies. Therefore, taking ESG-adjusted cost of debt into account can significantly impact company valuations in DCF, motivating companies to enhance their ESG initiatives in order to reduce their overall cost of capital.

Another common way to incorporate ESG considerations into the discount rate is to include a risk premium when companies perform poorly on ESG indicators, resulting in a lower present value and valuation. The opposite is true when a discount is provided to companies with strong ESG performance (JLL, 2022). Meanwhile, the issues persist in that the degree of changes isn't uniform and is strongly dependent on subjectivity. ESG scores might also vary greatly depending on the industry. Additionally, to prevent double counting and maintain accuracy, incorporating ESG elements into a value through a discount rate needs to be done carefully. It is crucial to determine if the market has already factored in the risks or opportunities when determining the industry-wide discount rate.

2.2.3. ESG and the Terminal Value

When applying the DCF model, the computation of the terminal value and its inclusion presume that the firm will perpetually operate in a way that generates cashflows. Industries with high inherent ESG risks, such as coal mining, are expected to be gradually abandoned in favour of more sustainable industries, like renewable energy. This shift, driven by the growing appetite of investors for renewable energy sources, will likely lead to a significant decline in the terminal value of companies operating in these high-risk industries, potentially reaching 0 in extreme cases. In addition, as more countries announced pledges to achieve net zero emissions by 2050, appropriate adjustments should be considered carefully in the terminal value calculation to reflect these goals (JLL, 2022).

Frédéric Le Meaux's Valuation and Sustainability chapter (2023) recommends limiting the WACC or Terminal Value adjustment to ± 100 basis points (bp). The size of the adjustment should be determined by

the importance of the ESG issue under consideration. A substantial ESG issue may demand a ± 50 bp modification, while a small or less relevant issue may just require a ± 10 bp change (PKF, 2024).

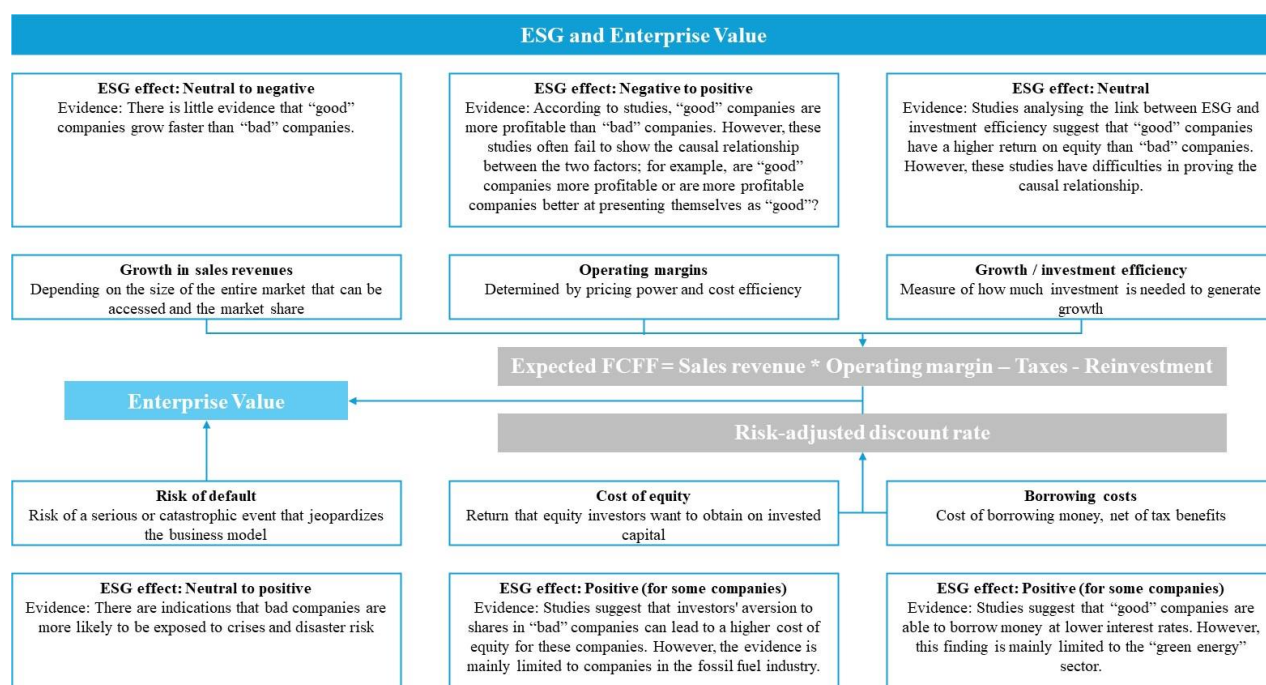


Figure 2.1: The link between ESG and company value in a Discounted Cashflow analysis (*The ESG Movement, Damodaran*)

2.3. Market approach

The market approach, or relative valuation, calculates an asset's fair value by valuing comparable assets using common variables including earnings, cashflows, book value, and revenues. This approach calculates the company's valuation by multiplying a financial metric. Multiples are usually calculated from the median or average of comparable companies based on geography, size, and operational (growth, margins) criteria. The Price-to-Earnings (P/E) ratio, which compares a company's share price to its earnings per share, the Price-to-Book (P/B) ratio, and the Enterprise Value-to-EBITDA (EV/EBITDA) multiple are the most used multiples (Damodaran, 2002). The EV/EBITDA multiple helps compare companies with different capital structures (Lie & Lie, 2002).

One of the key benefits of employing comparable analysis is that relative valuation methods are simple and more user-friendly compared to intrinsic valuation models like DCF. This simplicity makes the process less time-consuming and less reliant on complex financial projections, which can often be a source of significant

uncertainty. Additionally, these methods reflect current market conditions and investor sentiment as they are based on real market data. However, several implementation challenges remain. Users must make numerous decisions to conduct a comparable analysis effectively, including selecting appropriate comparable firms, choosing between accrual-based or cash flow-based value drivers, deciding on the use of reported versus expected earnings, determining how to measure averages, considering the impact of firm size, applying an illiquidity discount and a control premium, and addressing accounting differences (Plenborg & Pimentel, 2016).

2.3.1. The choice of comparable companies

When selecting comparable companies, investors need to assess the most relevant ESG criteria based on the chosen characteristics they value most. Popular credit rating companies Moody's, Fitch Ratings, and S&P Global Ratings (S&P) have included ESG factors into their rating systems. Financial data companies such as Moody's, Bloomberg, Refinitiv, and MSCI have also developed their own ESG score system, which is a useful tool for comparing options in the market.

One approach to evaluate the risk profiles and comparability of companies is to incorporate the ESG score into the credit rating analysis (JLL, 2022). Companies with lower ESG scores run a greater risk because they may underperform their competitors in terms of talent retention and resource management. Like credit risks, the enterprise value of a company, and consequently the spread yield and expected returns, may be impacted by the degree of ESG risk. Price multiples will therefore fluctuate in line with the comparable companies' performance as determined by ESG standards.

2.3.2. Target multiples adjustments

Alongside adjusting the selection of comparable companies, one can adjust the target multiple to incorporate ESG factors. When examining commonly used multiples such as price-to-earnings (P/E) ratios and price-to-book (P/B) ratios, it is possible to factor in a price premium for companies that perform well in terms of ESG, or conversely, apply a discount. Multiples can be adjusted based on the ESG performance of the observed peers (Roedl, 2023). While infrequently employed, this approach attempts to include ESG factors in a straightforward and systematic way.

Due to the surging interest in ESG performance, investors are increasingly willing to pay a higher premium for companies with strong ESG ratings (Damodaran, 2021). A recent empirical study revealed a significant alpha return for companies that demonstrated exceptional performance on material ESG factors. This

discovery provides more evidence that investors are ready to pay a higher price for such companies. Therefore, to factor ESG considerations into valuation, it is imperative to apply a premium to the target multiple when valuing companies that have high ESG scores.

As the interest in ESG performance continues to grow, investors are increasingly willing to pay a higher price for companies that have strong ESG scores (Damodaran, 2021). A recent study conducted by FCLTGlobal and the ESG Analytics Lab at the Wharton School of the University of Pennsylvania found that companies with strong performance on material ESG factors were able to generate higher returns. Specifically, the study revealed that firms prioritizing a multi-stakeholder approach, and exhibiting robust ESG practices, achieved a 4% increase in returns over a period of three years, as measured by return on invested capital (ROIC). These companies also experienced a 1.5% increase in sales' growth and more stable returns, resulting in a decrease of 9% in predicted ROIC volatility over the same period. This suggests that investors may be willing to pay a premium for companies with strong ESG performance due to their enhanced stability and growth potential.

2.4. Challenges in incorporating ESG in valuation

Having access to reliable ESG data is crucial for integrating sustainability factors into valuation. However, collecting this data can be quite challenging. Analysts frequently come across challenges related to data availability, concerns about data quality, and the lack of comparability between different sources. These obstacles can undermine the entire valuation process because when ESG data is unreliable, irrelevant, or incomplete, it can lead to misleading and inaccurate valuation results.

The lack of satisfactory current and historical data poses a significant challenge when it comes to integrating ESG factors into valuation. Even among public companies, it is challenging to find comprehensive ESG data disclosure. As an illustration, a recent study conducted by FTSE Russell and Refinitiv revealed that 42% of large and mid-cap companies worldwide have yet to disclose both Scope 1 and 2 emissions (PKF, 2024). Surprisingly, even prominent companies such as Berkshire Hathaway and Moderna are among those who have not made this information public. This is further exemplified by the G&A Institute's 2023 Sustainability report which shows that a significant portion of companies, while increasingly adopting sustainability reporting practices, still face challenges in providing consistent, year-over-year comparable data.

Furthermore, the lack of comprehensive ESG regulations enables corporations to selectively share data, resulting in incomplete and inconsistent information. In addition to lax regulation, the voluntary nature of ESG disclosure contributes to selective reporting practice. This depicts an incomplete and sometimes misleading image. Additionally, there is rising concerns about the potential of greenwashing, in which some corporations overstate or misrepresent their sustainability measures in order to appear more ecologically responsible. This can make it much more difficult to appropriately evaluate data. Companies that are not yet mature in terms of ESG sometimes lack a solid data governance structure. Therefore, poorly managed systems and controls might produce outdated, inconsistent, or altered data, reducing the reliability of the information at hand.

The lack of standardization in this area comes partly from the existence of various frameworks, including the GRI Standards, the SASB, and the TCFD recommendations. Companies have the freedom to select various frameworks and methodologies to measure and report their ESG performance, leading to inconsistencies in measurement and reporting. It can therefore be quite challenging to compare the ESG performance of two companies when they use different reporting frameworks.

Even when data is available, assessing its quality can be quite problematic. Based on a benchmarking study conducted by the International Federation of Accountants (IFAC), an analysis was done on 50 Singapore companies in 2021. One of the main findings revealed that out of the 48 companies that provided sustainability information, 21% received a certain level of assurance on it.

All these challenges show the importance of addressing the issues of data accuracy and reliability when valuing a company. Indeed, despite the growing recognition of the link between strong ESG performance and financial performance, our literature review reveals a significant gap in the quantitative integration of ESG into valuation models. Existing research primarily focuses on qualitative assessments and the DCF model, and there is clear lack of standardized and quantitative methods to incorporate ESG criteria into Comparable Companies analysis. Bridging this gap is essential to provide a more holistic assessment of a company's true value and risk profile.

3. Methodology framework

3.1. Research Design

Our research aims to provide a reliable and comprehensive framework for integrating ESG factors into Comparable Companies valuation. The primary objective of this design is to develop a robust methodology for factoring ESG criteria into the Comparable Companies (or Multiples valuation), focusing on large-cap companies in European markets.

In the preliminary phase of our thesis, we engaged extensively with ESG analysts at Five Arrows Principal Investments (Rothschild & Co.'s Private Equity arm). Through these discussions, we explored methodologies for integrating ESG factors into company valuation and identified a critical gap: the market currently does not price ESG criteria effectively. This observation let us to formulate one of our core hypotheses: the market undervalues companies with strong ESG performance and overvalues those with poor ESG performance.

Building on this hypothesis, we developed the concept of applying a premium or discount to valuation multiples based on a company's own ESG performance. More specifically, companies that perform well compared to their peers would receive a valuation premium, while companies that perform relatively poorly would receive a discount. This concept forms the foundation of our valuation framework, which we will apply this methodology consistently across the main industry groups (Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Healthcare, Communication Services) that use similar multiples for their valuations. We chose to focus on European markets because companies in this region operate under similar regulatory frameworks, providing a consistent basis for comparison.

Our valuation framework is predicated on the assumption that companies with similar operational and financial characteristics should have similar valuations. Discrepancies in valuation reflect different levels of risk between companies operating in the same industry and geography, as investors tend to favour less risky companies. To adapt this method to an ESG-based valuation, we integrate ESG criteria into traditional valuation multiples. This integration aims to provide a more comprehensive valuation, reflective of all both financial and ESG-related risks borne by a company.

- **Hypotheses**

- (i) **Market mispricing of ESG:** Markets currently do not price effectively ESG criteria into company valuations.

- (ii) **ESG-adjusted valuation multiples:** Applying ESG-based premiums and discounts to valuation multiples will result in more accurate and comprehensive company valuations.
- (iii) **Sector consistency:** ESG-adjusted valuation multiples can be systematically applied across different sectors to provide a holistic view of a company's value and short-term and long-term risk profile

This research aims to investigate how ESG criteria can influence company valuations in Comparable Companies analysis, addressing the gap in existing frameworks that often overlook the integration of ESG factors in this specific valuation method. A secondary goal was to establish a framework that would be easy to implement and applicable to any multiples valuation to encourage investors to take it into account. We see this approach as complementary to the traditional Comparable Companies analysis, enabling investors and financiers to have a more holistic view of the risks borne by the companies they look at. Indeed, we believe that an ESG-adjusted multiple valuation would also be more reflective of the risk borne by companies, as poor ESG performance increases the risks for all stakeholders in the company and leads to increased reputational and transitional risks for the company (as it will have to deploy more capital to reach targets imposed by regulatory authorities). Physical risks, or the increased risk of natural disasters due to company activity, are other risks that affect all stakeholders and result from poor ESG performance.

We first collected data from companies, sector by sector, in order to perform our ESG-multiple valuation. During the data collection process, we focused on all the large-cap companies per sector in Europe, according to Capital IQ as of June 15, 2024, to ensure that our output would be representative of significant market players, minimize the impact of small-cap biases, and treat companies that have the potential and resources to perform well ESG-wise. We extracted financial metrics and ratios from Capital IQ to get the basis for our experimental framework.

After choosing the companies that form the foundation of our framework, we examined various databases to determine which ESG ratings to incorporate into our analysis. After evaluating Moody's, Refinitiv's, and Bloomberg's ratings, we chose Moody's ESG ratings due to both their comprehensive coverage and robust methodology, which provide a forward-looking evaluation of the ESG risks. Our study aligns with the comparative and relative nature of these ratings, which factor in a wide array of ESG metrics and enhance comparability across different companies and industries. Indeed, Moody's ESG scoring method provides a detailed analysis of a company's commitment to and effectiveness of sustainability practices, thereby offering a comprehensive view of a company's ESG performance.

After having extracted companies' financial metrics and ESG ratings, we went on to perform peer group benchmarking to obtain a standardized score using the min-max standardization method. We first computed the average ESG rating of the peer group to set a baseline for comparison. We then normalized the rating using the maximum possible difference within our set by subtracting the minimum rating from the maximum rating within the data set. This normalization process allows us to standardize coefficients used in valuation adjustments. This process also ensures that companies with ESG ratings above the industry level receive a premium, whereas the valuation of companies below average incurs a discount. In addition, we incorporated a scaling factor adjusting to a company's baseline EV/EBITDA in order to ensure that the ESG-adjusted multiple does not overly distort the company's valuation, especially when the baseline multiple is very high. We then multiply the initial EV/EBITDA by the ESG coefficient to obtain the ESG-adjusted valuation multiple.

To deal with outliers, we looked at the highest and lowest values for the baseline EV/EBITDA multiples. Including these datapoints in our analysis would, on the one hand, change how we understood the data, and on the other, make the ESG-adjusted multiple change too much when the baseline multiples were very high. To identify outliers, we have used the interquartile range (IQR) method and excluded data points that fell below $Q1 - 1.5IQR$ or above $Q3 + 1.5IQR$.

3.2. Data collection

The data collection process laid the groundwork for the subsequent analysis of ESG-adjusted multiples valuation. This section outlines the approach taken to gather relevant data, ensuring robustness and reliability in the analysis.

3.2.1. Selection of companies

The goal was to select a sample of companies from specific industry groups in order to perform a comparative valuation analysis before and after applying the ESG coefficient. For our research, we decided to focus on all European large-cap companies within each industry group. This method ensures a comprehensive and representative analysis for each sector while also limiting the effect of small-cap biases.

Our focus on large-cap companies ensures that our analysis includes the largest and most influential companies, which have the potential to make significant progress in ESG and enhance the sector's overall performance. Furthermore, our selection allows our research to represent market leaders, who often set industry standards and trends and whose performance can impact the whole sector.

Indeed, selected companies have a tangible impact on the financial performance and valuation trends within each industry group. By establishing a peer set that includes all large-cap companies, we ensure the inclusion of the most significant players in each industry group, whose performance significantly influences both sector average and median multiples. Furthermore, this provides a holistic view of each industry group's ESG and financial performances, allowing us to identify sector-specific trends and measure the overall impact of ESG factors within the sectors. Another reason we chose to concentrate on these large companies is to ensure data availability and homogeneity, as they face more regulatory pressure and have access to superior resources to improve their ESG practices. This makes the data collection process more robust, resulting in a more accurate analysis. Indeed, small-cap companies may lack the resources to implement and develop comprehensive ESG practices, and their stocks usually exhibit more volatility. Therefore, focusing on large-cap companies allows us to reduce the bias and variability that including small-cap companies would introduce compared to well-established firms. In addition, our selection criteria enable us to perform a comparative analysis across sectors, observing ESG-adjusted multiples and other financial measures across different industries on a like-for-like basis.

We focused our analysis on European companies for several key reasons that justify better comparability within our industry sets. First, in order to recreate a Comparable Companies set, it is essential to look at the geography criterion and at companies in countries that have the same level of risk and regulatory environment. Indeed, by selecting companies from members of the European Union or from countries with close ties to the EU, we ensure that we look at companies that fall under a comprehensive, consistent, and similar regulatory framework concerning ESG practices, ensuring uniformity in reporting. They follow the same initiatives, such as the European Green Deal 2020 or the EU Sustainable Finance Package 2023, and hence have the same incentive to improve their ESG performance. Secondly, European companies are subject to strict disclosure requirements and ESG regulations, enhancing transparency and accountability. Lastly, Europe appeared to be a suitable region for our study: it is currently the most mature geography on the matter since it represents more than 50% of all regulations on ESG, highlighting an emphasis on both sustainability and corporate responsibility, and thus aligning with the goal of our research.

Regarding our industry classifications, we used categories traditionally employed by finance professionals: Communication Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Healthcare, Industrials, Materials, Real Estate, and Financials. These widely recognized classifications facilitate comparability across the different databases used in our research, particularly Capital IQ and Orbis.

We chose not to cover Financials and Real Estate because their financial statements and valuation multiples differ significantly from those of other industries, making comparison irrelevant. On the one hand, Financial Institutions typically use metrics such as P/E rather than EV/EBITDA since for most Financial Institutions, especially banks, their EBITDA is not representative of their financial health because their interest incomes are not yet included in their EBITDA. On the other hand, Real Estate companies often use valuation multiples based on Net Asset Value (NAV) or Funds From Operations (FFO), again differing from the EV/EBITDA multiple used in our analysis.

Another sector we excluded from our final analysis is Information Technology (IT). This is due to the high dispersion in the observed baseline valuation multiples. This wide variance prevented us from deriving meaningful and comparable results across the companies in the sample.

For the Consumer Discretionary, Healthcare, and Industrials sectors, we decided to split them into sub-industry groups to enhance comparability as these sectors encompass companies with diverse activities. Thus, we split the companies within the Consumer Discretionary group into Automotive and Components, Consumer Retail and Apparel, and Consumer Services. For Industrials companies, we split between Capital Goods and Transportation. For the Healthcare sector, we divided it into two subgroups: Pharmaceuticals, Biotechnological and Life Sciences, and Healthcare Equipment and Services. By doing this split, we ensure that the companies being compared are more similar in terms of both operational characteristics and market dynamics, recreating a Comparable Company peer set that would traditionally be used in financial analyses.

3.2.2. Data sources

We sourced data for our selected companies from reliable and widely used financial databases, Capital IQ and Orbis. On the one hand, we used Capital IQ data for the financial information on each firm sampled, including market capitalization, Enterprise Value, financial metrics, and multiples. It provided real-time data based on publicly available information. On the other hand, we gathered ESG indicators using Moody's ratings obtained through the Orbis database. We designed our research to identify ESG ratings that we could use to compute coefficients for our ESG-adjusted multiples valuation. We looked at Refinitiv, Bloomberg, and Moody's.

We decided to keep Moody's rating as the foundation for our methodology framework due to the credibility and renown associated with Moody's in the financial sector. Financial institutions and investors widely trust Moody's ratings for their rigorous and continuous analytical frameworks and forward-looking assessments

of credit ratings and ESG factors. The comprehensive nature of Moody's ESG methodologies, which are transparently published and updated, provides a robust basis for evaluating the ESG performance of companies. Moody's ESG ratings are computed using a combination of quantitative and qualitative analysis. The organization first collects relevant ESG data from public disclosures, regulatory filings, and proprietary data sources. They look at both historical data and forward-looking estimates. They incorporate a wide range of ESG-related data points, including environmental impact metrics (e.g., carbon emissions, energy efficiency), social responsibility indicators (e.g., employee safety, diversity and inclusion), and governance quality measures (e.g., board composition and independence, executive compensation, and alignment with performance)

After collecting data, Moody's uses an ESG Score Predictor Model, which relies on statistical techniques to estimate ESG scores based on the collected data. Expert rating committees supplement this quantitative approach with qualitative evaluations, ensuring holistic assessments of an entity's ESG performance. These experts take into account additional qualitative factors like management quality, industry context, and recent developments that may impact ESG performance. We also believe that Moody's ESG scores are relevant because they adjust the ratings based on the sector in which companies operate, which allows them to keep the ratings within a certain range (0–100). To adjust ratings, Moody's identifies sector-specific factors that may influence ESG performance. These factors include industry norms, adapting to specific regulatory environments, and considering common practices within each sector. A calculation of corrective terms follows, and the output of the ESG Score Predictor model is adjusted to reflect the relative ESG performance within each sector context.

Additionally, we believe that Moody's ratings are relevant as evaluations adjust to the size of companies. Indeed, it is essential for ESG ratings to provide adjustments as larger companies generally have access to a wider array of resources compared to smaller companies and hence can invest significantly in ESG initiatives, allowing them to adapt to evolving regulatory frameworks and reduce both their transition and reputational risks. By adjusting for capitalization biases, Moody's ratings reflect the actual performance of a company relative to its size, preventing large companies from appearing superior due to their resource advantage. Therefore, this ensures that the ESG ratings do not favour larger companies. Moody's performs this adjustment by calculating ESG scores using an exposure-weighted average, which gives the most weight to the most material ESG issues for each company in the rating process. Size-specific corrective terms are then computed and included in the final ESG score calculation.

The **corrected** ESG score is given by:

$$\text{Corrected ESG score} = \text{Initial ESG score} + \text{Specific corrective terms}$$

Moody's then publishes this score, ranging from 0 to 100. Investors and financial institutions should interpret the results as per Figure 3.1 below to assess the ESG performance and associated risk of a company.



Figure 3.1: ESG Assessment Scale (*Moody's*)

The organization's level of transparency and reliability ensures that our analysis is grounded in a widely accepted benchmark.

In summary, the data collection process for our research is designed to be methodical and systematic, ensuring that our ESG-adjusted multiples are based on robust data and that our method can be systematically implemented.

3.3. Valuation adjustments

In this section, we outline the methodology for adjusting traditional valuation multiples to factor in ESG criteria and reflect the risks associated with poor ESG performance. Our goal is to propose a valuation framework that does not only reflect the companies' financial performance and risks but also their ESG performance. The hypothesis that the market does not currently price ESG criteria into valuations guides our method of applying premiums or discounts to valuation multiples based on a company's relative ESG performance in its industry.

3.3.1. Establishing the Baseline Multiple

After having extracted the data from Capital IQ for each company in our sectors of interest, we calculate the baseline EV/EBITDA multiple for each company in the sample. These baseline multiples will serve as reference points for our subsequent analysis and evaluation of the impact of ESG-adjusted multiples. To establish a benchmark for each industry, we aggregate the multiples of the companies within a set and calculate their central tendency measures, i.e., the average and median EV/EBITDA multiple. While the average underlines the general industry trend, the median multiple provides a measure that is less influenced by outliers. Using both measures ensures that our baseline is representative of typical industry conditions.

We decided to perform our analysis using the EV/EBITDA multiple for several reasons. Firstly, it provides a comprehensive view of a company's value and capital structure as it includes both equity and debt, making it a more inclusive metric compared to P/E, for example, which only takes equity into account. In addition, the EV/EBITDA metric is a broadly recognized and accepted metric in financial analysis and has wide applicability across various industries, enabling cross-sectoral analysis. Lastly, EV/EBITDA focuses on a company's operating performance by excluding the effects of expenses that can be subject to accounting manipulation (Depreciation and Amortization), differences in taxation, and effects of capital structures (Interest payments). This ensures that the valuation multiple is reflective of the operational efficiency of the company rather than financial engineering. Overall, this reliable metric allows for the assessment of the operational performance of a business, independent of its capital structure and other factors external to its operational activities.

We decided to use the last FY EBITDA for all companies to enhance the reliability and accuracy of our analysis by relying on audited financials and a standardized timeframe for comparison, thus balancing forward-looking elements of Moody's ratings.

3.3.2. Handling outliers

As we observed that outliers have the potential to significantly skew the results, especially when the baseline multiple is at an opposite extreme of the company's ESG score (i.e., a very low multiple compared to peers but a very high ESG score), we sought a methodology to handle outliers to produce an ESG-adjusted Multiples valuation that would mirror the traditional approach used in financial analysis.

- **Impact of outliers on ESG-adjusted valuation**

Firstly, companies with extreme multiples can distort the calculated ESG-adjusted valuation multiples, resulting in a flawed reflection of a company's true value. For instance, an extremely low ESG score coupled with a very high baseline multiple could result in an unrealistic adjustment.

Secondly, it was crucial to treat outliers in order to mitigate their influence on statistical measures, especially peer average and standard deviation, which values are critical in normalizing ESG ratings, calculating the ESG coefficients and analysing the results.

Thirdly, the presence of outliers can hinder the comparability of valuation multiples within and across sectors, introducing biases that can lead to inaccurate comparisons and misleading insights. For instance, extreme adjustments might suggest non-existing trends or obscure genuine trends essential for understanding the ESG-adjustments.

- **Method for handling outliers in our framework**

This study employs the Interquartile range (IQR) method to treat outliers and mitigate their influence. This approach excludes datapoints that fall outside of the IQR bounds, ensuring that extreme values do not affect the analysis in a disproportionate way and that we do not overly artificially alter the financial metrics of our datapoints.

The IQR method involves the following steps:

- (i) Calculate the first quartile (Q1) and the third quartile (Q3) of the data set.
- (ii) Compute the IQR, the range between Q3 and Q1, hence calculated as $IQR = Q3 - Q1$
- (iii) Set the outlier boundaries, with the lower bound as $Q1 - 1.5 IQR$ and the upper bound as $Q3 + 1.5 IQR$.
- (iv) Exclude all data points that fall outside of the boundaries, therefore deemed as outliers.

This method ensures that our analysis reflects a more accurate and representative range of the company valuations, mitigating the risk of excessively skewed results due to extreme values and provides a coherent grasp of the central tendency and multiples distribution within our set. By handling outliers effectively, we enhance the reliability of our methodology, offering financial institutions and policymaker a sound approach to incorporating ESG factors into public valuations.

3.3.3. ESG ratings and normalization

After having collected financial and ESG data for the sectors and companies of interest, we normalized ratings among peers in order to maintain consistency and comparability. To do so, we have used a min-max normalization approach. This method ensures that the relative ESG performance of each company is

reflected and that companies with a score above average are given a premium in their valuation whereas companies below average incur a discount. The normalization also allows the study to maintain the relative nature of multiples valuation; ensuring that the adjustments made reflect the additional risk or opportunity associated with a company's ESG performance compared to its peers. The formula used for normalization is:

$$\text{Normalized ESG rating} = \frac{(\text{Company ESG rating} - \text{Average ESG})}{(\text{Max ESG rating} - \text{Min ESG rating})}$$

The difference between the maximum ESG rating and the minimum ESG rating is called the Maximum Possible Difference. Let's take the Transportation sector for example. The minimum score in the dataset is 41.0, the maximum is 69.0, and the average is 54.8. The company DSV with an ESG rating of 64.0 would have a normalized rating of:

$$\text{Normalized ESG rating} = \frac{(64.0 - 54.8)}{(69.0 - 41.0)} = 0.37$$

3.3.4. Calculation of the scaling factor

Our methodological framework incorporates a scaling factor to adjust the ESG coefficient based on the company's initial EV/EBITDA multiple. This factor ensures that the impact of ESG criteria on company valuations is proportionate and does not overly affect valuation, especially those with higher baseline multiples (for which only a 10% change in valuation would change a lot in terms of EBITDA). We chose to implement a logarithmic scaling factor as the logarithmic function increases at a decreasing rate, which means that as the baseline EV/EBITDA multiple increases, the adjustment factor grows at a slower pace. This characteristic is particularly relevant for reducing the excessive influence of ESG coefficient on companies with large multiples, while preserving the relative comparability across companies in each set.

To compute the scaling factor, we first normalize the baseline multiple of each company to a range between 0 and 1. This is achieved by subtracting the minimum observed multiple in our set from the company's multiple and then dividing by the range of the multiple. The formula used is:

$$M_{norm} = \frac{M_i - M_{min}}{M_{max} - M_{min}}$$

Where M_i is the company's baseline multiple, M_{min} and M_{max} are the respective minimum and maximum multiples in the set observed. Once we have obtained the normalized multiple, we use it to compute the scaling factor α using logarithmic transformation:

$$\alpha = \alpha_{min} + \log(1 + M_{norm} \times (\alpha_{max} - \alpha_{min}))$$

Here, α_{min} and α_{max} represent respectively the minimum and maximum values of the scaling factor. These bounds were set between 0.1 and 0.5. While the lower bound of 0.1 makes sure that there is a minimum level of ESG impact, the upper bound prevents excessive adjustments, preserving the integrity of baseline financial metrics. These specific bounds were determined after empirical testing and theoretical considerations, like Le Meaux's adjustments in the modified DCF (2023), to balance both the robustness and the sensitivity of the adjustment. This method ensures that the adjustment remains within a reasonable range while reflecting the ESG performance in the newly computed multiple. By applying this scaling factor to the ESG coefficient, the resulting ESG-multiples are balanced across companies of varying sizes, maintaining integrity and comparability in our valuation analysis.

Re-using our previous example for DSV and the transportation industry, we have a minimum baseline EV/EBITDA of 5.8x in the set, a maximum multiple of 17.0x and DSV's baseline EV/EBITDA is 14.8x. We obtain:

$$M_{norm} = \frac{14.80 - 5.80}{17.00 - 5.80} = 0.80$$

$$\alpha = 0.10 + \log(1 + 0.80 \times (0.50 - 0.10)) \approx 0.221$$

3.3.5. Calculation and application of ESG coefficient

Once the ratings are normalized for all companies in the industry set, the next step is to calculate the ESG coefficient for each company. The ESG coefficient is designed to adjust the traditional valuation multiples based on the company's ESG performance relative to its peers. The formula used is the following:

$$ESG \text{ coefficient} = 1 + (\text{Normalized ESG rating} * \alpha)$$

Reusing our previous example, DSV's coefficient would be approximately 1.081.

After having calculated the coefficient for each company within the set, the coefficient is used to adjust the valuation multiple:

$$ESG - Adjusted\ EV/EBITDA = Baseline\ EV/EBITDA * ESG\ coefficient$$

Still keeping our example from, DSV has an ESG-adjusted EV/EBITDA multiple of 16.0x.

In summary, our valuation adjustment process integrates ESG criteria into traditional comparable company analysis, providing an alternative framework that proposes a comprehensive assessment of company value reflecting simultaneously financial and ESG performances.

The relevance of this methodology relies on 4 pillars:

- (i) Comparability:** The normalization of ESG ratings ensures that the scores obtained are comparable across different companies and industries, providing a basis for adjustment.
- (ii) Reflection of Relative Performance:** The min-max normalization adjusts the valuation multiple based on the company's ESG performance relative to its peers, maintaining the relative essence of traditional Multiples valuation.
- (iii) Holistic Valuation:** The incorporation of ESG factors into valuation provides a comprehensive assessment of a company's value, not solely limited to financial performance.
- (iv) Market Alignment:** This method aligns with modern investment practices that seeks to integrate ESG factors into financial analysis and investment decisions. The proposed framework is easy to systematically implement and act as a complement of traditional valuation methods, reflecting the additional relative ESG risk of companies.

4. Discussion

4.1. Brief recap of method & objectives

Our research aims to provide a comprehensive framework for factoring ESG criteria into public markets valuation by applying a coefficient to the baseline multiples, based on the Moody's ESG score of the company. We collected financial and ESG data for large-cap European companies across various sectors, using Capital IQ and Orbis' (where Moody's ratings are available) data. We normalized the ESG ratings using the min-max standardization method, allowing us to later standardize coefficients and allowing for comparability across companies. We then adjusted the baseline EV/EBITDA multiples of each company based on the normalized ESG rating. A scaling factor was applied to the ESG coefficient to ensure that the impact of ESG criteria was proportionate and did not overly distort the company's valuation. To identify and exclude outliers we used the interquartile range method, ensuring accuracy and representativeness of our analysis.

Furthermore, we performed a correlation analysis to determine whether ESG performance was already priced in baseline EV/EBITDA multiples. This led us to validate the hypothesis that ESG factors are not currently priced into public valuations. By analysing the strength and direction of these correlations across different sectors, we ensured that our systematic methodology appropriately adjusts valuations for ESG criteria without introducing significant biases.

Our final objective is to develop a robust methodology that reflects a comprehensive valuation encompassing both financial and ESG performance, while maintaining the relative essence of a Comparable Companies analysis. The final goal is to provide insights for investors to systematically and easily integrate ESG criteria into their investment decisions and for policymakers to promote ESG integration in financial analyses.

4.2. Interpretation of Results

4.2.1. General findings

The integration of ESG factors into Comparable Companies valuation revealed several important trends and insights across various sectors.

Firstly, we observed that correlation between baseline multiples and ESG ratings was very weak for all sectors, and sometimes negative, reinforcing our belief that the market currently does not price ESG. The discrepancies in correlation coefficient (from moderately negative to weakly positive) may also indicate that the benefits of ESG integration are less direct or more challenging to quantify in some industries. For instance, while operational efficiencies and risk management are clear benefits in sectors like Pharmaceuticals, they may be less apparent or harder to measure in service-oriented industries.

We notice that the integration of ESG factors across all sectors generally resulted in minimal changes regarding data dispersion and standard deviation, pointing that the magnitude of the ESG coefficient is balanced and allows to maintain comparability within the ESG-adjusted multiple range. Indeed, the standard deviations before and after ESG adjustments remained stable, suggesting that our method provides a consistent framework for adjusting valuation to ESG performance without introducing additional volatility. This ensures that the set of ESG-adjusted multiples closely mirrors the baseline set, maintaining reliability and comparability. However, the impact of ESG integration is not uniform across all sectors.

The method aligns with the theory that companies with robust ESG practice should in the long-term experience less volatility in their stock prices and better manage market-wide shocks. With the ESG coefficient, this stability is reflected in their valuations, which are less likely to be negatively impacted during periods of social or economic instability. These findings are consistent with previous research, which has shown that strong ESG performance provides significant downside protection and should foster long-term financial stability (Bhaskaran et al., 2020; De Lucia et al., 2020).

The largest changes in EV/EBITDA multiples were observed in sectors where ESG ratings had the highest dispersion, highlighting heterogeneity in ESG practices in the Pharmaceuticals Biotechnology and Life Sciences and Utilities sector. Conversely, smaller adjustments in sectors like Materials and Consumer Staples highlight more homogeneity in ESG practices in the sector.

Adjustments in ranking of companies' multiples relative to their peers post-ESG integration were noted, demonstrating the power of pricing ESG coefficients and that it can outbalance other short-term lags that a company may have and that may be priced in by the market (i.e. quarterly earnings below expectations)

4.2.2. Correlation analysis

Firstly, our goal was to find out if there was a positive correlation between ESG ratings and baseline multiples that would reject our hypothesis that the market does not currently reflect ESG criteria in public valuations.

	Correlation	Strength	Sample size
Automobiles and Components	(0.58)	Moderate	10
Capital Goods	0.15	Negligible	37
Communication Services	0.03	Negligible	10
Consumer Retail and Apparel	(0.06)	Negligible	12
Consumer Services	0.14	Negligible	5
Consumer Staples	(0.21)	Weak	21
Energy	(0.26)	Weak	10
Healthcare Equipment and Services	(0.30)	Weak	10
Materials	0.33	Weak	21
Pharmaceuticals, Biotechnology, and Life Sciences	0.22	Negligible	13
Transportation	0.02	Negligible	9
Utilities	0.11	Negligible	19

Figure 4.1: Summary of correlation coefficients per sector

Sectors like Automobiles and Components with a moderate negative correlation of -0.58 (Figure 4.1) hint that ESG risks were not initially well-integrated into valuations. This observation indeed aligns with our belief that better ESG-performing companies are currently not receiving any premiums based on their reduced risk profiles and long-term sustainability advantage.

Indeed, as per figure 4.1, the weak to moderate negative correlation for Automobile and Components, Healthcare Equipment and Services, and Energy, the negligible correlation for Consumer Retail and Apparel, Transportations, Communication Services, Consumer Services, Capital Goods, Pharmaceuticals Biotechnology and Life Sciences, and the weak positive correlation for Materials suggest that the market does not recognize yet the benefits of strong ESG performance and thus does not reward leaders in sustainable and corporate practices. This mixed results and modest coefficients illustrate the ongoing debates in the literature about the magnitude and consistency of ESG impacts on financial performance and firm value (Whelan et al., 2021). This highlights a market inefficiency where myopic investors overlook the long-term non-financial value that ESG-compliant companies bring. Indeed, in line with De Lucia et al. (2020), considering that companies with high ESG performance tend to demonstrate enhanced risk management, operational efficiencies, and stronger stakeholder relationships, they should exhibit higher valuations compared to their peers. Yet, the negative correlation coefficients imply that these characteristics are not reflected into public valuations, supporting our hypothesis that the market does not account for ESG performance.

Additionally, we observe that sectors with moderate negative relationships are industries with highly polluting companies (especially Automobiles and energy). This highlights the unequal integration of ESG factors into valuation, underscoring again the broader market efficiency created by the gap between ESG performance and valuation and confirming that investors still rely almost solely on traditional financial metrics, overlooking extra-financial indicators.

These preliminary observations contribute to validate our hypothesis that the market does not yet price ESG criteria and that an ESG-adjusted valuation could complement investor's view and lead to more sensible and holistic financial analyses and investment decisions, in line with true risk profile and comprehensive performance of public large-cap companies. While these findings support our hypothesis, we recognize that this analysis is based on correlation and not causation. The relationships between ESG ratings and baseline multiples lead us to the conclusion above but do not definitively prove that the market does not price ESG criteria. Other underlying factors may be influencing these results, and further research, such as running regressions on baseline EV/EBITDA multiples controlling for other drivers of multiples (revenues, market share...), could validate our observations.

4.2.3. Cross-sector analysis

This cross-sector analysis seeks to explain how integrating an ESG coefficient impacts companies' valuation. This relies on the premise that multiples are not reflective of a company's relative ESG performance compared to its peers. This analysis aims to demonstrate the relevance of our ESG coefficient computation method. The goal is not only to highlight sector-specific trends but to draw insights into the overall effectiveness and reliability of our ESG-adjusted valuation methodology by comparing dispersion, adjustments, and ranking changes across sectors.

<i>In absolute value</i>	Average adj.	Max adj.	Min adj.
Automobiles and Components	5.09%	12.2%	0.7%
Capital Goods	4.15%	9.2%	0.1%
Communication Services	3.68%	7.5%	0.3%
Consumer Retail and Apparel	5.18%	9.7%	0.6%
Consumer Services	5.40%	9.7%	1.4%
Consumer Staples	3.98%	8.2%	0.2%
Energy	4.83%	10.8%	0.7%
Healthcare Equipment and Services	3.76%	10.3%	0.4%
Materials	2.99%	8.1%	0.5%
Pharmaceuticals, Biotechnology, and Life Sciences	4.19%	14.8%	1.0%
Transportation	4.97%	8.5%	0.7%
Utilities	4.60%	12.1%	1.1%

Figure 4.2: Average, maximum, and minimum multiples adjustments per sector

We have noted the most impactful sector-specific findings in the context of our research objectives.

- **Automobiles and Components**

- The sector exhibits one of the highest average adjustments in absolute value across sectors, with 5.09% (Figure 4.2), indicating a strong response of valuations to ESG scores.
- The highest baseline valuations incurred a discount whereas the lowest ones received a premium after adjustment. Indeed, the largest negative change observed is for Renault, whose valuation went from 11.0x to 9.7x EV/EBITDA (Figure 7.1.1), corresponding to a 12.2% decrease in Enterprise Value (Figure 4.3), i.e. the maximum decrease post-adjustment observed across all sectors. However, the company still exhibits the highest valuation both before and after adjustment. On the other hand, Stellantis and Continental, the lowest baseline multiples, saw their multiple increase after ESG-adjustment of respectively 0.95% and 7.34% (Figure 4.3). This is explained by the negative correlation between ESG ratings and baseline multiples observed for this industry, and the ESG premium for lower multiples will not push them to the level of companies with high baseline multiple.

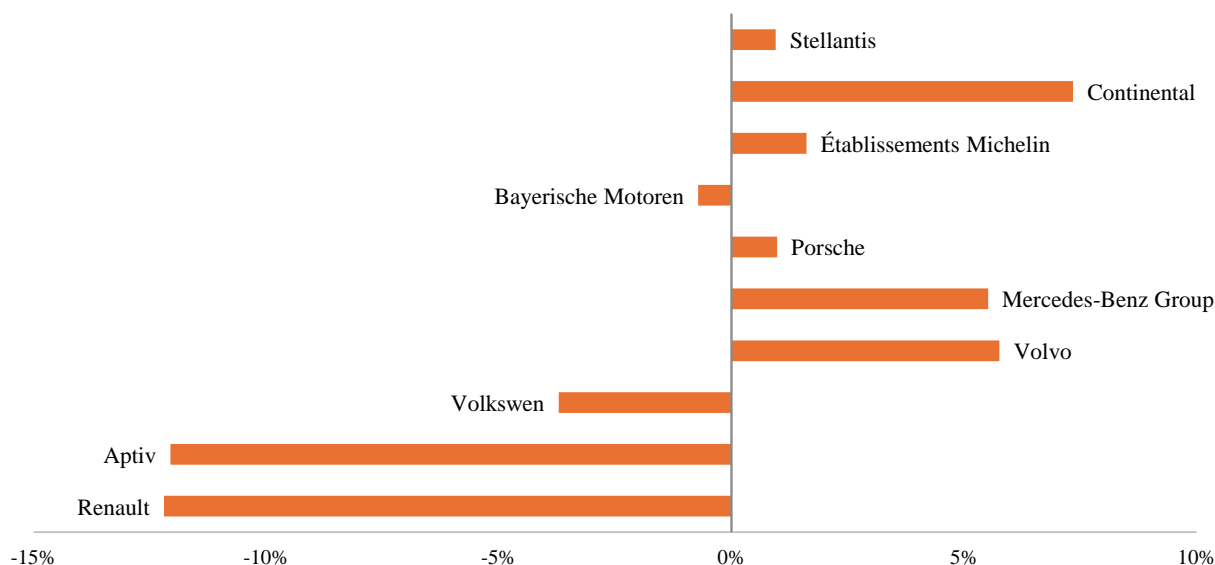


Figure 4.3: ESG premiums & discounts – Automobile and Components

- **Communication Services**

- Overall, we observe very minimal adjustments in ESG-adjusted multiples, which is explained by the fact that most ratings for companies in this industry are highly concentrated around the mean. The maximum adjustment in absolute value is 7.5% whereas the smallest is 0.1% (Figure 4.2), resulting in the smallest range adjustment across sectors.
- However, for the few companies with ESG scores further away from the mean, we still observe notable changes. This is especially the case for Informa, the highest baseline multiple among the set, which ESG-adjusted multiple is one EBITDA turn below its baseline's multiple, from 13.9x to 12.9x (Figure 7.3.1).
- The adjustments in rankings were minimal, implying a consistent approach to ESG practices in the industry.

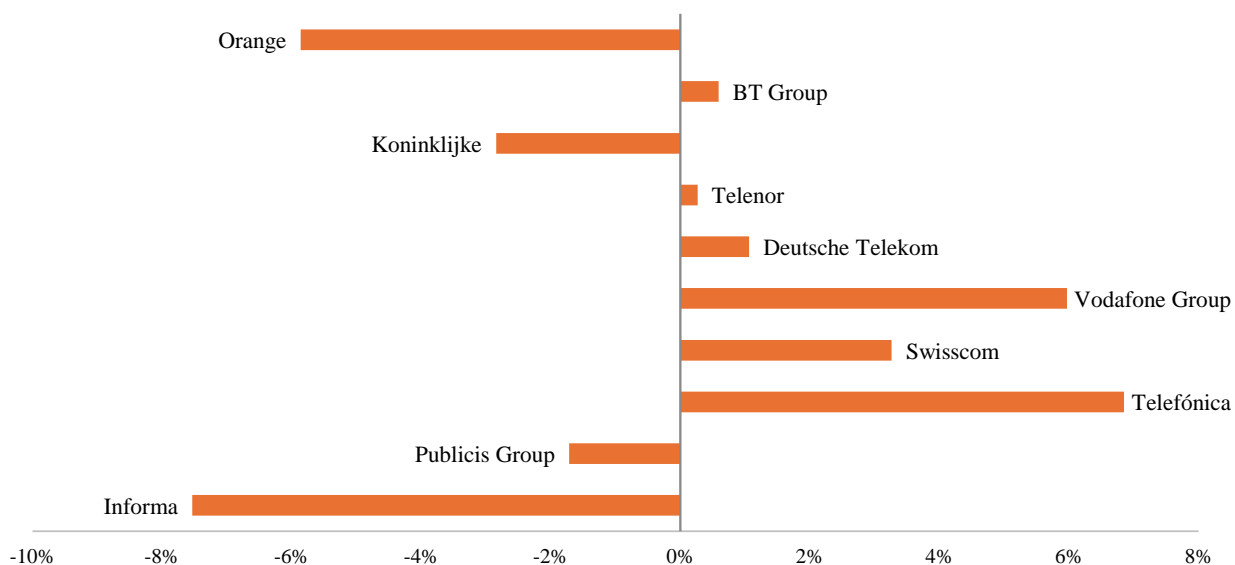


Figure 4.4: ESG premiums & discounts – Communication services

- **Energy**

- Shell's multiple increased by 10.3%, from 6.3x to 6.9x (Figure 7.7.1), moving from 4th to 2nd place within its industry set. This improvement highlights how our methodology can recognize significant ESG initiatives and elevate the valuation of strong ESG performers relative to their peers.
- Most companies experienced a slight decrease in multiples post-adjustment, highlighting the negative correlation pre-adjustment between ESG and valuation in the Energy sector.

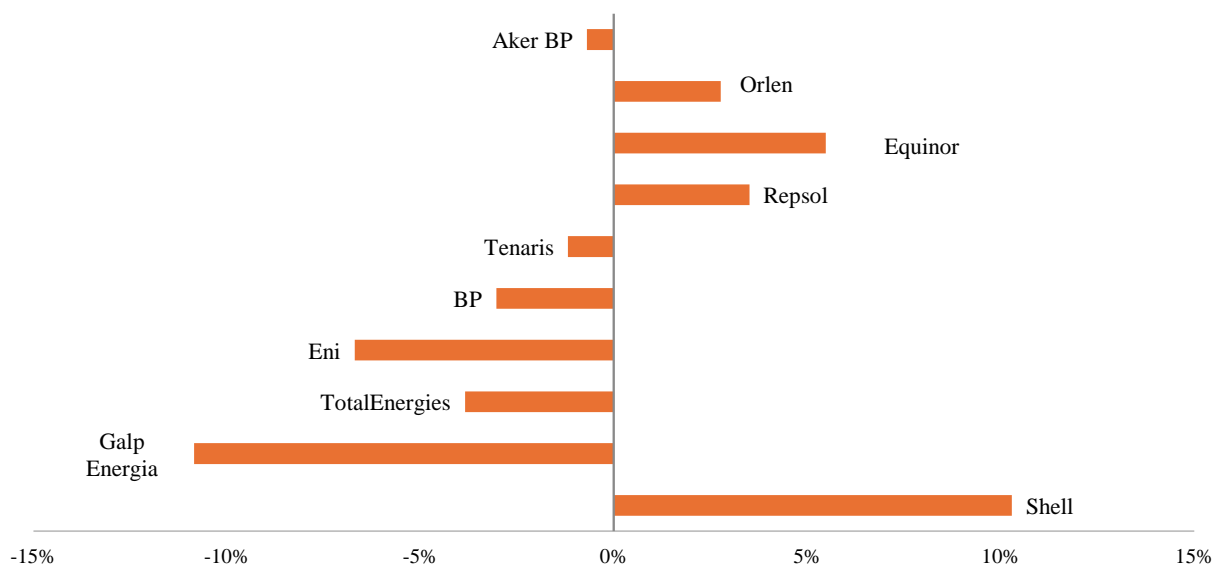


Figure 4.5: ESG premiums & discounts – Energy

- **Pharmaceuticals, Biotechnology and Life Sciences**

- The sector demonstrated substantial changes in valuation multiples and exhibited a wide range of ESG coefficients, highlighting significant variability in ESG practices among companies and hence an increased sensitivity of valuations to ESG performance in this sector.
- Sartorius' EV/EBITDA increased significantly from 26.7x to 30.7x (Figure 7.8.1), highlighting its competitive ESG score compared to its peers and potential for bearing much less risk in the short-term. With a 14.8% increase in valuation post-adjustment, it is the company with the highest adjustment across all sectors (Figure 4.2).
- There has been shifts in ranking in this industry, explained by the large dispersion of ratings and hence practices within the sector. Strong performers took over companies with initially higher multiples. For example, Lonza Group improved from 4th to 3rd in ranking and Sanofi from 12th to 11th (Figure 7.8.1). Indeed, this industry is known for having the potential to implement ESG practices that can benefit all stakeholders; hence, discrepancies in practices can lead to disparate ESG scores and thus adjustments in multiples.

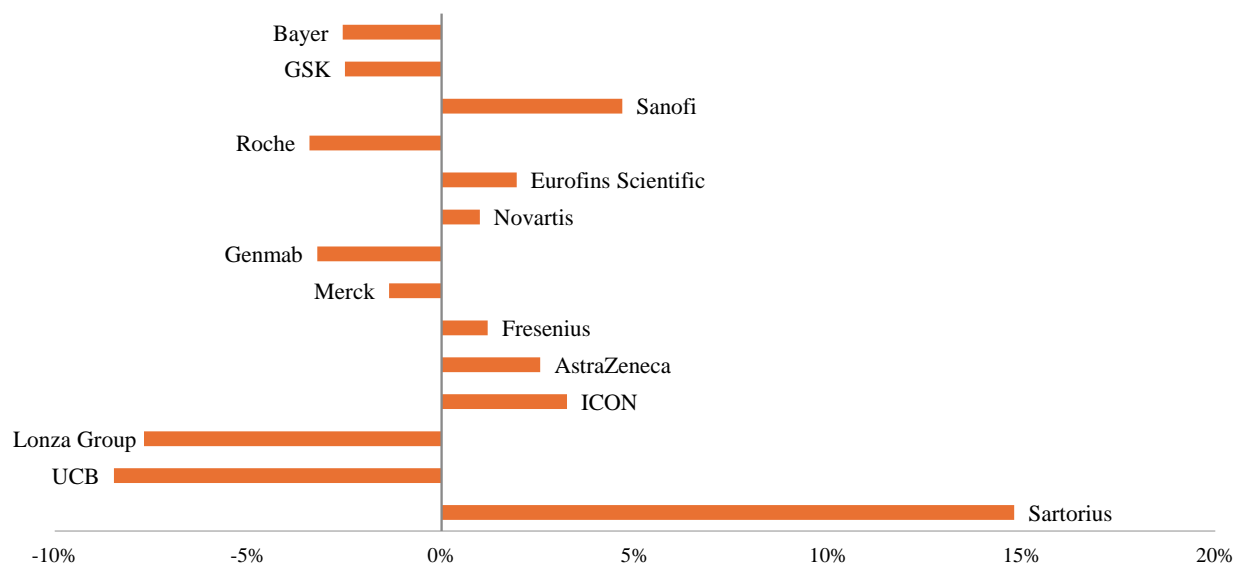


Figure 4.6: ESG premiums & discounts – Pharmaceuticals, Biotechnology and Life Sciences

- **Cross-sector insights**

Overall, the analysis confirms our hypothesis on the market inefficiencies regarding ESG pricing. Multiples variations before and after adjustments confirm our hypothesis that the market does not fully price ESG criteria into valuations. The dispersion analysis and changes in multiples' rankings post-adjustment demonstrate the reliability of an ESG coefficient implementation into valuation without overly distorting the multiples from the baseline, ensuring that financial implications account for most of the valuation. This systematic framework highlights the effectiveness of integrating ESG criteria into valuation, thus providing a more comprehensive assessment of a company's performance and risk exposure.

Furthermore, changes in rankings suggest that when ESG factors are integrated into valuation, high ESG-performing companies that may bear short-term risks are rewarded for their long-term risk hedging. This indicates that the methodology has potential for inducing a market correction, recognizing the true value of ESG practices and risks while maintaining the comparative nature of Comparable Companies analysis.

Regarding sector variability, different sectors exhibit diverse levels of ranking changes, reflecting the unique impact of ESG factors. Sectors like Automobiles and Components experienced significant changes, with notable improvements for ESG leaders that were lagging in valuation before adjustments. For Energy and Utilities, sectors under high regulatory scrutiny and which face high environmental expectations, there were significant adjustments, demonstrating the disparities in ESG practices and the relevance of pricing these in, since in theory ESG-leading companies should exhibit less risk in the long-term. On the other hand, the sector with the lowest average adjustments in absolute value were Materials (2.99% average adjustment), highlighting more homogeneity in ESG practices in the sector and hence a lower dispersion of multiples, leading to smaller adjustments.

Furthermore, the previous correlation analysis, combined with an analysis of the average adjustments per industry reveals a pattern where industries with a negative correlation between ESG ratings and baseline multiples exhibit mostly negative adjustments, while those with positive correlation saw positive adjustments. This validates our methodology by showing that it effectively prices ESG criteria in a manner consistent with their underlying relative ESG performance.

Overall, the cross-sector analysis reveals the significant potential of ESG factors when incorporated into relative valuation, especially for sectors high ESG expectations (especially in sustainability) and regulatory

pressure. The relatively stable standard deviations and range³ across most sectors indicate that our ESG-adjusted multiples maintain comparability and not introduce additional volatility in the peer set. Notable changes in rankings and high average adjustments in absolute values underscore the market inefficiencies in pricing ESG criteria and validates the need for an ESG-adjusted valuation framework.

4.2.2 ESG premiums and discounts

The analysis of ESG premiums and discounts reveals significant variations across different sectors, highlighting the impact of ESG performance on company valuations. Overall, the distribution of premiums and discounts reflects the market's increasing recognition of ESG factors as integral to a company's financial health and sustainability.

With our methodology, companies with strong ESG performance will receive premiums on their valuation multiples. For example, Vodafone Group in the Communication Services sector saw an increase in its EV/EBITDA multiple from 8.6x to 9.1x, representing a 7% premium due to its strong ESG score of 73 (Figure 7.3.1). Similarly, in the Consumer Retail & Apparel sector, Compagnie Financière Richemont experienced a notable premium of 10%, with its EV/EBITDA multiple rising from 15.8x to 17.4x, reflecting its robust ESG practices (Figure 7.4.1). Conversely, companies with lower ESG scores will face discounts. Renault in the Automobile & Components sector, for instance, experienced a 12% discount, with its EV/EBITDA multiple dropping from 11.0x to 9.7x due to its lower ESG score of 41 (Figure 7.1.1). Similarly, with a score of 32, Galp Energia in the Energy sector faced a significant discount of 11%, with its multiple decreasing from 5.1x to 4.6x (Figure 7.7.1).

The distribution of these premiums and discounts across sectors indicates that we can increasingly factor ESG performance into valuations. This trend underscores the importance of sustainability and ethical practices in enhancing a company's perceived value and long-term viability. In sectors such as Pharmaceuticals and Consumer Staples, where the benefits of ESG integration are more direct and measurable, the impact on valuation multiples is particularly pronounced. For instance, Pernod Ricard in the Consumer Staples sector saw its multiple increase from 14.5x to 15.6x, consistent with its high ESG score of 68 (Figure 7.6.1).

³ See box plots sector by sector in Appendix

However, the impact of ESG adjustments is not uniform across all sectors. In some sectors, the impact of ESG on the adjusted valuations were weaker. For example, in the Industrials sector, companies like Bouygues saw only a slight discount of 1%, despite a relatively moderate ESG score. This suggests that while ESG factors are influential, their impact can vary significantly depending on industry-specific dynamics and the directness of ESG benefits. Indeed, because our ESG coefficient is relative to peers, a score of 48 with an industry average of 53, will only result in a 1% discount for Bouygues while remaining a low score in absolute terms (Figure 7.2.1).

A notable case illustrating the significant impact of ESG adjustments is observed in the Healthcare sector. Sartorius, which specializes in providing equipment and services for the biopharmaceutical industry, has achieved a high ESG score of 73 due to its strong focus on sustainable practices, particularly in environmental and social governance, such as reducing carbon emissions, ensuring product safety, and promoting diversity and inclusion within the company. With our methodology, the company saw its EV/EBITDA multiple increase from 26.7x to 30.7x (Figure 7.8.1), resulting in a substantial 14.8% premium (Figure 4.2). This significant adjustment would be a very good reflection of the market's strong recognition of Sartorius's high ESG score of 73 and its positive implications for the company's risk profile and long-term prospects. The high dispersion in the Healthcare Pharmaceuticals, Biotechnology, and Life Sciences sector reflects a wide range of ESG practices, hence leading to a higher sensitivity of multiples to different ESG performance levels.

Overall, the way our methodology is structured means that a high dispersion in ESG coefficients within a sector indicates a high variability of ESG practices within the industry. Sectors with high dispersion of premiums and discounts, such as Pharmaceuticals, Biotechnology, and Life Sciences and Consumer Retail and Apparel, exhibit substantial variability in ESG performance, underscoring discrepancies in ESG practices in each industry, with some clear leaders and laggards. Conversely, sectors with smaller dispersion imply a more homogeneous ESG performance across companies in the industry. This is the case for the Energy and Utilities sector (Figure 4.2) and can be explained by the strong regulatory pressure under which are companies in the industry.

4.3. Implications for theory & practice

4.3.1. Investment strategies

Our research emphasizes a systematic and quantitative approach that investors can incorporate into their investment process in order to make better-informed decisions that encompass a wide range of criteria.

Firstly, investors may use ESG-adjusted multiples to better include sustainability performance of firms into valuations, allowing them to pinpoint inexpensive firms that exhibit robust ESG procedures while avoiding overpriced companies that have a weak ESG performance. In the long-term, this can provide an additional hedge against various risks that traditional financial analysis may miss, such as regulatory risks, environmental liabilities, and social controversies that have not been identified yet by the market.

Secondly, this methodology can contribute to the elaboration of an ESG-focused portfolio with a balanced risk profile, especially in the long-term, due to a minimized exposure to firms that have inadequate ESG practices. Our methodology also allows for sector-specific adjustments tailored to the unique ESG dynamics of each industry. This can support investors in building a more diversified portfolio that considers both the financial and ESG implications of different sectors. For example, in the Energy sector, the divergent impacts of the coefficients on companies like Shell (positive adjustment from 6.3x to 6.9x) and Galp Energia (negative adjustment from 5.6x to 5.1x) underlines the importance of considering sector-specific considerations in order to achieve a diversified and balanced portfolio.

Thirdly, this methodology allows for investors to account the sector-specific ESG dynamics. Various industries display different amounts of dispersion in their ESG coefficients, which indicates the range of variety in ESG practices. Investors can adapt their ESG integration practices and the interpretation of the different coefficients to match the characteristics of each industry.

In addition, the proposed methodology aligns with the goals of long-term investors, especially those focused on Best-in-class and Thematic strategies, as it directly highlights better performing companies on ESG matters relative to a sector. By systematically incorporating ESG factors into their financial analyses, investors can support companies that are better positioned for long-term success and resilience.

Lastly, by establishing a quantitative basis for ESG adjustments, our methodology encourages active ownership and engagement from investors. This ESG-adjusted valuation can incentivize investors to engage

with portfolio companies on specific ESG issues, and advocate for improvements that could enhance their ESG performance and thus their valuation. This can ultimately directly incentivize companies to adopt stronger ESG practices in order to achieve a higher market valuation and gain easier access to capital.

Our ESG-adjusted multiple methodology has the potential to influence investors' decision-making processes, as it offers a systematic approach that provides a holistic valuation, and supports diversified and sustainable investment strategies. Incorporating ESG factors into analyses in valuations imply a more comprehensive assessment of a firm's value and hence aligns with long-term sustainability and returns goals.

4.3.2. Implications for policy makers and regulators

Our methodology for integrating ESG criteria into valuations entails significant implications for policymakers and regulators. By fostering a standardized and systematic approach to integrating ESG into valuation, policymakers and regulators can enhance transparency, comparability, and accountability in financial markets and valuations.

Firstly, policymakers and regulators should advocate for the implementation of uniform ESG reporting, to foster uniformity and comparability of ESG data among enterprises and cross sectors. With their ability to incentivize corporations to embrace sustainable practices and financial institutions to favour investments in ESG-leading companies, regulators have the potential to bolster market stability, and to foster long-term value creation. This can be done by implementing policies that encourage to consider ESG criteria into valuation and investment decisions. This in turn could ensure that corporations are held responsible for their ESG activities and hence take initiatives to improve their ESG metrics.

Therefore, investors and governments can improve the inclusion of sustainability considerations in financial analysis by respectively integrating ESG criteria into their investment strategies and advocating for consistent ESG reporting, enhancing in the long-term the sustainability of organizations. It's important to note however that for such policy to be effective, there should be further research on whether considering ESG criteria into valuation does indeed create long-term value and reduces company risk.

4.4. Limitations of the study

We have identified several challenges and areas of potential bias in our framework. Addressing them could enhance the robustness and reliability of our valuation method.

The first limitation is for applicability. On the one hand, applying our methodology requires a deep understanding of the industry and drivers of ESG performance to interpret sector-specific results. Extended knowledge could allow to tailor the methodology to different sectors in order to provide a more scaled result. our framework could be improved by introducing flexibility in metrics, allowing to adapt to different sectors and multiples. These adaptations require establishing sector-specific and coefficient that can align with the multiples commonly used in the industry as well as with industry norms.

Secondly, our methodology relies on the hypothesis that there is no double-counting issue since we assume no strong positive correlation between ESG performance and EV/EBITDA multiples currently. A more robust statistical analysis, controlling for other factors influencing multiples of large-cap European companies, could allow us to further validate this hypothesis and ensure the robustness of our method. Furthermore, if investors adopt a less myopic view and change their investment practices, these multiples may adjust automatically.

Another limitation lies in the choice of peers, which can significantly influence the industry average. The selection of comparable companies directly impacts the derived multiples and, consequently, the ESG adjustments. This introduces a degree of subjectivity and variability, as different sets of peers can lead to different valuation outcomes. The extent to which the EV/EBITDA multiple is adjusted based on the ESG score varies greatly with the chosen peer set. The more peers included in the analysis, the closer the adjustment tends to be to zero, indicating a dilution of the ESG impact when a larger, more diverse peer group is used.

Data availability and comparability pose additional challenges. Despite the growing emphasis on ESG disclosure, there remains a lack of standardized reporting frameworks, leading to inconsistencies and gaps in the data. This can undermine the accuracy of our ESG adjustments, as incomplete or non-comparable data may not fully capture the ESG performance of companies. Furthermore, the voluntary nature of ESG disclosures and the potential for greenwashing—where companies may overstate or misrepresent their ESG practices—add another layer of complexity and potential bias to our analysis.

As discussed in the literature review, the lack of standardization in ESG reporting frameworks (Busch & Bassen, 2015) and the presence of greenwashing (Clément, Robinot, & Trespeuch, 2023) present significant challenges for obtaining reliable data.

The implications of ESG on risk and return also present a nuanced picture. While companies with lower multiples may be perceived as higher risk, they could also present opportunities for investors seeking higher returns. The inverse relationship between risk and return suggests that lower multiples might attract investors who are willing to accept higher risks for the potential of greater returns. This dynamic must be carefully considered in our analysis, as it could influence investor behaviour and market valuations. This aligns with the findings in the literature review, where the relationship between ESG performance and financial returns was found to be complex and sometimes conflicting (Griffin & Mahon, 1997; Rowley & Berman, 2000; Revelli & Viviani, 2015).

We could therefore improve our methodology by ensuring application and applicability across sectors and multiples by tailoring our approach to specific industries and implementing some flexibility in metrics. Furthermore, we would need to ensure that we do not double-count ESG risk when factoring in our coefficient, by ensuring that there is indeed no link between ESG performance and market valuation, The use of only one rating, the lack of standardized ESG reporting, and the potential for greenwashing pose significant data reliability issues. Finally, to enhance the comprehensiveness of our analysis, an in-depth understanding of the implications of ESG on risk and return is necessary. Addressing these limitations will strengthen our methodology while providing more accurate insights into the integration of ESG into Comparable Companies analysis.

5. Conclusion

5.1. Recap of objectives

This thesis aims to develop a comprehensive framework for integrating ESG (Environmental, Social, and Governance) criteria into the Comparable Companies valuation method. Our research was driven by the goal to create a systematic way to quantitatively incorporate ESG factors into valuations, more specifically the Comparable Companies method. We sought to develop an approach that would distribute premiums and discounts to companies' valuation multiples based on their ESG performance. We first collected financial data and Moody's ESG scores for large-cap European companies in the main industries (Automobiles and Components, capital Goods, Communication Services, Consumer Retail and Apparel, Consumer Services, Consumer Staples, Energy, Healthcare Equipment and Services, Materials, Pharmaceuticals Biotechnology and Life Sciences, Transportation, Utilities). After computing their EV/EBITDA multiples, we adjusted them using Moody's ESG score through a min-max standardization approach, in order to maintain comparability across companies within a sector. To ensure that the impact of the ESG coefficient would not overly distort the valuation, we applied a scaling factor based on the magnitude of the initial EV/EBITDA multiple. This method allowed for a quantitative integration of ESG metrics, resulting in valuation reflecting both financial and ESG performances. In complement to other valuation methods, this framework offers investors a practical tool for making informed decisions that account for ESG criteria.

5.2. Restatement of current ESG framework

The current ESG framework is characterized by high fragmentation and varying standards across industries. Our literature review underscored the need for standardized and systematic approaches to integrating ESG into valuation, as the popularity of sustainability-themed investment is growing. Research consistently demonstrates that incorporating ESG considerations can enhance firm value, profitability, and long-term sustainability by fostering innovation, improving operational efficiency, and mitigating risks. Numerous studies highlight positive correlations between ESG practices and financial performance, although some findings indicate potential downsides, underscoring the complexity of this relationship.

Historically, ESG integration has largely revolved around qualitative assessments, including ESG reporting. However, recent advancements have seen researchers attempt to quantitatively integrate ESG criteria into valuations. For instance, the DCF model has been adapted to reflect ESG impacts by adjusting projected cash flows and discount rates. Companies with strong ESG profiles may experience more stable and higher

cash flows due to improved operational efficiency, better risk management, and enhanced innovation capabilities. The discount rate can also be adjusted to reflect lower systematic risks associated with strong ESG performance, resulting in a lower cost of capital and higher valuations.

Additionally, the Value-Driver Adjustment (VDA) approach introduced by Schramade links ESG factors to key value drivers like sales growth, profit margins, and the cost of capital. By systematically adjusting these drivers based on ESG performance, this method quantifies the impact of ESG factors on a company's valuation. However, integrating ESG criteria into DCF or the VDA approaches presents challenges, as it requires access to significant data and necessitates making substantial assumptions. Other, simpler methods of valuing a company, such as comparable company analysis, remain largely unexplored in the literature regarding the integration of ESG criteria. Until now, the most common approach has involved assigning a premium or discount to companies, often in an arbitrary and unsystematic manner.

Despite the clear benefits and increasing research on ESG integration, significant challenges persist. Data availability, quality, and standardization remain critical issues that can undermine the reliability of ESG assessments. The voluntary nature of ESG disclosures and the lack of consistent reporting frameworks contribute to these challenges, making it difficult to compare the ESG performance of different companies accurately.

Nonetheless, the necessity for a systematic and quantifiable approach to incorporating ESG factors into valuations is evident. Bridging the gap between qualitative assessments and quantitative integration in valuation models is essential for providing a holistic and accurate reflection of a company's true value and risk profile.

5.3. Summary of findings

Our analysis revealed significant variations in ESG impacts across sectors. Sectors under greater ESG scrutiny exhibited the highest impact, underscoring the mispricing of ESG criteria in current market valuations. Moreover, the variability in adjustments across industries highlight the differential importance of ESG factors.

- **Correlation analysis**

The correlation analysis demonstrated that industries with negative correlations between ESG ratings and baseline multiples tended to have negative average adjustments and vice versa. This pattern validates our

methodology by showing that it effectively adjusts for ESG criteria in a manner consistent with their underlying ESG performance. For instance, Automobiles and Components, with the highest negative correlation (-0.58) between baseline multiples and ESG scores is one of the sectors that exhibited the highest average adjustments in absolute value and the sector in which companies received the greater discounts due to their low ESG performance relative to their peers, highlighting the current market inability of reflecting ESG practices into public valuations.

- **Sector trends**

Automobiles and Components: Integrating an ESG coefficient into the multiples valuation revealed significant changes in terms of peer rankings: while the highest baseline valuations incurred a discount, the lowest ones received a premium after adjustment. These findings demonstrate how baseline EV/EITDA multiples did not reflect the ESG risks borne by companies.

Communication Services: This industry exhibited minimal adjustments, reflective of a more homogeneous approach to ESG practices sector wide. The largest premiums were about just 7%. This consistency in valuations suggests that ESG practices are relatively uniform across the sector, and the application of a coefficient only results in minor changes.

Energy: The sector exhibited divergent impacts with both positive and negative adjustments, reflective of disparate ESG performances. This is explained by the high regulatory pressure faced by industries in this sector, with high polluting potential. Efforts toward more sustainable practices are hence rewarded and allow ESG-leaders to differentiate from their peers, earning them a high relative ESG score and hence a high premium.

Pharmaceuticals, Biotechnology, and Life Sciences: High dispersion in ESG coefficients resulted in significant valuation changes. The sector exhibits the highest individual adjustments due to varying ESG practices among companies, affecting their ESG-adjusted multiples significantly.

Materials: With a 2.99% average adjustment in absolute value, this sector exhibits more homogeneous ESG practices among large-cap companies, explaining why they are less sensitive to their valuation adjustments

- **Cross-sector analysis of ESG premiums and discounts**

The analysis of ESG coefficients across sectors revealed varying ranges, with sectors like Consumer Retail and Apparel showing higher dispersion. This underscores significant differences in ESG practices among

peers, which our methodology attempts to capture in order to provide a valuation reflective of extra-financial criteria than can have significant impact on the long-term risks borne by a company.

5.4. Limitations of the study and future research directions

We identified several limitations to our study that should be addressed for future research.

Firstly, the problem of data availability and reliability inherent to ESG metrics poses some challenges to ensuring the robustness of our methodology: inaccuracies and gaps in data can undermine the accuracy of our ESG adjustments. More specifically, the voluntary nature of ESG disclosure and the risk of greenwashing can introduce a bias in our analysis and interpretation of results.

Secondly, the choice of peers can also introduce some biases, as the choice of peers directly impact the derived multiples and ESG scores, and consequently, the resulting ESG adjustments. To mitigate this, future research could explore more granular adjustment for different industries and test the sensitivity of multiples and ESG coefficients when the peer set is modified.

Thirdly, our methodology assumes that the lack of strong positive correlation between baseline EV/EBITDA multiples and ESG scores means that ESG criteria are not priced into current market valuations. A more robust statistical analysis controlling for other factors influencing multiples could contribute to strongly validate this hypothesis. Moreover, the absence of historical ESG data limit the possibility of performing longitudinal studies that could provide deeper insights into the impact of ESG integration on valuation and financial performance over time.

Future research could perform more granular adjustments to expand the applicability of our approach to additional valuation metrics, such as P/E, thus extending its relevance to other industries (Financials, Real Estate). Furthermore, research might test the methodology on companies of different sizes (small to mid-cap) in order to assess the robustness of this method. In addition, improving the reliability of this ESG-adjusted valuation method may be achieved by incorporating more sophisticated statistical techniques to ensure proportionate adjustments, avoid double counting criteria already priced in, and ensure the robustness of the data collected. Moreover, conducting longitudinal studies assessing the impact of ESG integration over time could provide valuable insights into the long-term benefits of the proposed framework. Implementing these improvements would ensure a more accurate and homogeneous integration of ESG elements into financial analyses, ensuring that the resulting valuation accurately reflects both the financial and ESG performances of the company.

5.5. Concluding remarks

This thesis highlights the need for systematic and quantitative methods to integrate ESG criteria into traditional valuation methods. It contributes to the field of ESG integration in valuation by providing a method for adjusting valuation multiples of publicly listed companies based on their ESG performance.

Our findings underscore the importance of incorporating ESG criteria for a more holistic assessment of a company's value, reflecting both financial and sustainability aspects. This framework offers investors, policymakers, and companies a practical methodology for ESG integration, ensuring that ESG factors are adequately considered in financial decisions. By proposing a systematic approach, our research proposes complementary analysis tool for investors, policymakers, and companies, supporting better investment strategies, hedge against long-term risk, and more informed decision-making among all stakeholders.

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7. Appendix

This appendix provides the output, sector by sector, of the ESG-adjusted multiples, their distribution, and the correlation between ESG scores and baseline multiples.

In \$mm

7.1 Automobiles and Components

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Renault SA	France	13,708.5	48,195.0	59,912.5	5,430.0	11.0x	41.0	(0.495)	0.246	9.7x
Aptiv plc	Ireland	19,347.9	18,662.2	25,061.1	2,661.1	9.4x	40.0	(0.541)	0.223	8.3x
Volkswagen AG	Germany	58,665.4	269,549.0	270,281.4	31,791.0	8.5x	48.0	(0.177)	0.209	8.2x
AB Volvo (publ)	Sweden	49,092.8	45,725.6	63,732.8	7,574.8	8.4x	58.0	0.277	0.208	8.9x
Mercedes-Benz Group AG	Germany	65,523.7	124,641.0	153,767.7	19,583.0	7.9x	58.0	0.277	0.199	8.3x
Dr. Ing. h.c. F. Porsche AG	Germany	67,122.5	35,885.0	69,793.5	9,046.0	7.7x	53.0	0.050	0.197	7.8x
Bayerische Motoren WerkeAG	Germany	57,343.5	118,333.0	143,131.5	22,741.0	6.3x	51.0	(0.041)	0.174	6.2x
Michelin SCA	France	27,046.9	28,343.0	30,490.9	5,098.0	6.0x	54.0	0.095	0.169	6.1x
ContinentalAG	Germany	12,172.4	40,902.5	18,045.4	3,315.4	5.4x	62.0	0.459	0.160	5.8x
Stellantis N.V.	Netherlands	77,191.8	188,853.0	59,962.8	27,714.0	2.2x	54.0	0.095	0.100	2.2x
Min		12,172.4	18,662.2	18,045.4	2,661.1	2.2x	40.0	(0.541)		2.2x
Max		77,191.8	269,549.0	270,281.4	31,791.0	11.0x	62.0	0.459		9.7x
Average		44,721.5	91,908.9	89,417.9	13,495.4	7.3x	51.9	0.000		7.1x
Median		53,218.2	46,960.3	61,847.8	8,310.4	7.8x	53.5	0.073		8.0x

Figure 7.1.1: Summary table of financial metrics and ESG adjustments – Automobiles and Components

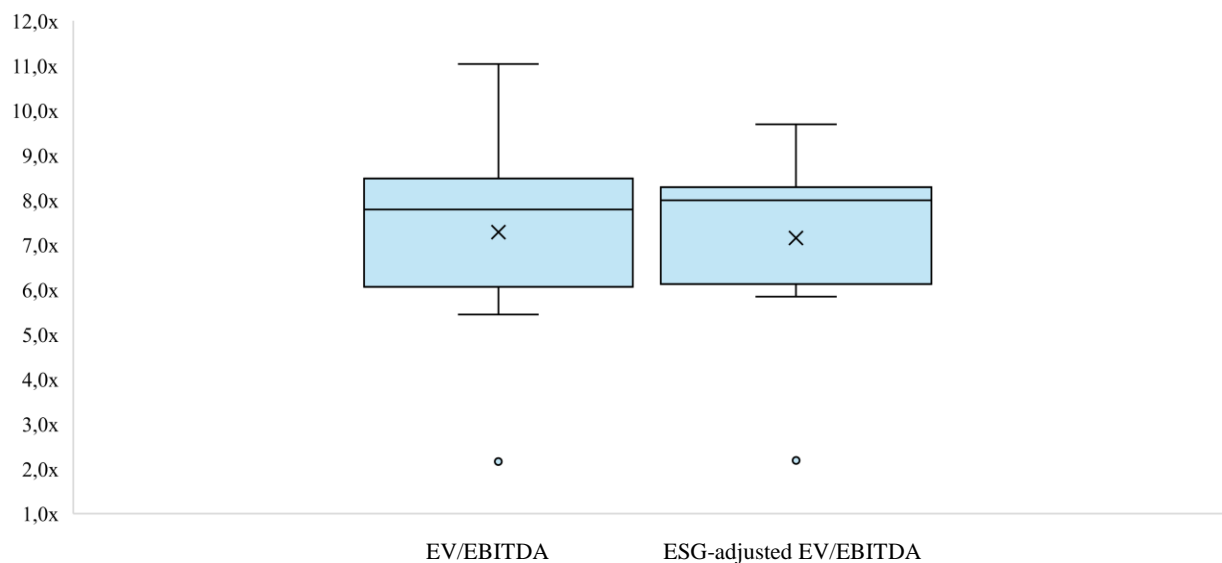


Figure 7.1.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Automobiles and Components

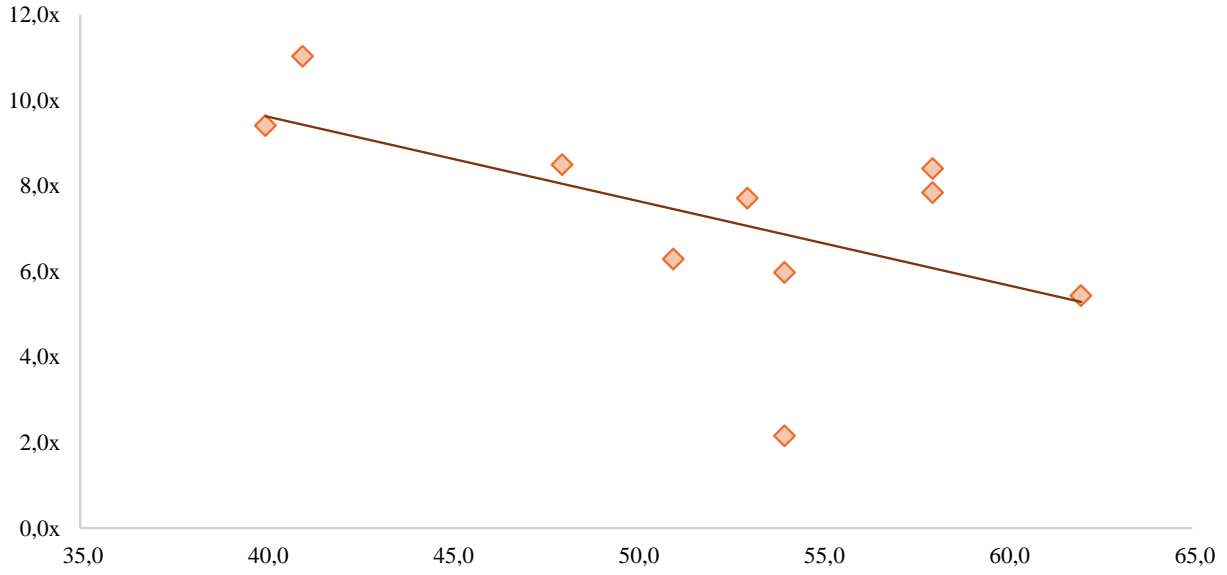


Figure 7.1.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Automobiles and Components

7.2 Capital Goods

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Eaton Corporation plc	Ireland	118,965.4	21,926.7	125,846.7	4,680.8	26.9x	60.0	0.143	0.246	27.8x
Saab AB	Sweden	12,233.2	4,708.0	12,154.0	506.9	24.0x	65.0	0.256	0.229	25.4x
Trane Technologies plc	Ireland	68,609.5	16,894.9	72,387.2	3,082.1	23.5x	56.0	0.052	0.226	23.8x
Wärtsilä Oyj Abp	Finland	11,375.2	5,871.0	11,308.2	496.0	22.8x	59.0	0.120	0.221	23.4x
Atlas Copco AB	Sweden	83,511.2	15,229.4	85,155.5	3,823.4	22.3x	72.0	0.415	0.218	24.3x
Geberit AG	Switzerland	18,913.4	3,111.8	19,913.9	904.6	22.0x	53.0	(0.017)	0.216	21.9x
Hexagon AB	Sweden	27,738.7	5,450.0	31,203.7	1,440.5	21.7x	56.0	0.052	0.214	21.9x
Rheinmetall AG	Germany	22,464.2	7,394.0	24,068.2	1,134.0	21.2x	39.0	(0.335)	0.211	19.7x
Johnson Controls International plc	Ireland	44,310.2	24,870.6	55,888.4	2,746.4	20.3x	44.0	(0.221)	0.206	19.4x
Schneider Electric S.E.	France	126,392.9	35,902.0	137,537.9	6,784.0	20.3x	34.0	(0.448)	0.205	18.4x
Safran SA	France	85,682.8	23,651.0	86,116.8	4,411.0	19.5x	47.0	(0.153)	0.200	18.9x
ABB Ltd	Switzerland	95,987.2	29,888.8	99,712.9	5,224.0	19.1x	54.0	0.006	0.197	19.1x
Alfa Laval AB	Sweden	17,421.4	5,582.2	18,338.2	970.9	18.9x	44.0	(0.221)	0.196	18.1x
Airbus SE	Netherlands	117,383.2	66,513.0	114,802.2	6,278.0	18.3x	63.0	0.211	0.192	19.0x
Rolls-Royce Holdings plc	United Kingdom	46,128.8	18,997.9	48,652.8	2,673.5	18.2x	61.0	0.165	0.192	18.8x
KONE Oyj	Finland	24,272.0	10,963.9	23,755.1	1,418.3	16.7x	59.0	0.120	0.182	17.1x
Pentair plc	United Kingdom	12,060.8	3,793.9	14,016.1	838.4	16.7x	65.0	0.256	0.182	17.5x
Kingspan Group plc	Ireland	15,402.3	8,090.6	16,701.4	1,016.9	16.4x	49.0	(0.107)	0.179	16.1x
Dassault Aviation SA	France	14,895.8	4,804.9	7,786.6	476.3	16.3x	45.0	(0.198)	0.179	15.8x
BAE Systems plc	United Kingdom	49,385.0	26,594.3	52,650.3	3,252.0	16.2x	72.0	0.415	0.178	17.4x
Thales SA	France	34,120.9	18,428.4	38,614.0	2,386.4	16.2x	31.0	(0.517)	0.178	14.7x
Siemens AG	Germany	135,043.2	77,498.0	182,805.2	11,532.0	15.9x	75.0	0.483	0.176	17.2x
Schindler Holding AG	Switzerland	25,717.0	11,684.3	23,039.9	1,455.8	15.8x	65.0	0.256	0.175	16.5x
ASSA ABLOY AB (publ)	Sweden	30,519.6	12,442.1	36,461.6	2,316.5	15.7x	46.0	(0.176)	0.175	15.3x
Ferguson plc	United Kingdom	37,992.7	27,613.7	42,201.1	2,756.0	15.3x	73.0	0.438	0.172	16.5x
Legrand SA	France	25,336.5	8,295.5	27,614.4	1,818.0	15.2x	65.0	0.256	0.171	15.9x
AerCap Holdings N.V.	Ireland	16,288.0	6,397.1	57,686.1	3,805.1	15.2x	34.0	(0.448)	0.171	14.0x
Prysman S.p.A.	Italy	15,574.7	15,049.0	17,514.7	1,337.0	13.1x	51.0	(0.062)	0.156	13.0x
Sandvik AB (publ)	Sweden	24,445.0	10,796.0	28,319.8	2,197.0	12.9x	67.0	0.302	0.154	13.5x
ACS SA	Spain	10,398.2	36,334.2	13,627.2	1,099.4	12.4x	31.0	(0.517)	0.151	11.4x
Bunzl plc	United Kingdom	11,790.0	13,594.6	13,851.9	1,126.4	12.3x	44.0	(0.221)	0.150	11.9x
CNH Industrial N.V.	United Kingdom	11,676.6	19,868.1	35,561.2	2,935.5	12.1x	40.0	(0.312)	0.149	11.6x
Knorr-Bremse AG	Germany	11,703.1	8,110.9	12,716.7	1,125.0	11.3x	60.0	0.143	0.143	11.5x
Leonardo S.p.a.	Italy	13,410.4	15,921.0	17,638.4	1,654.0	10.7x	60.0	0.143	0.138	10.9x
Ashtead Group plc	United Kingdom	28,965.3	9,839.1	39,381.3	4,248.3	9.3x	57.0	0.074	0.127	9.4x
Glencore plc	Switzerland	67,109.0	197,069.9	90,910.8	13,660.1	6.7x	44.0	(0.221)	0.106	6.5x
Boygues SA	France	12,288.3	56,324.0	24,796.3	4,221.0	5.9x	48.0	(0.130)	0.100	5.8x
Min			3,111.8	7,786.6	476.3	5.9x	31.0	(0.517)		5.8x
Max			197,069.9	182,805.2	13,660.1	26.9x	75.0	0.483		27.8x
Average			23,932.6	47,587.5	3,022.5	16.7x	53.7	0.000		16.7x
Median			15,049.0	31,203.7	2,316.5	16.3x	56.0	0.052		17.1x

Figure 7.2.1: Summary table of financial metrics and ESG adjustments – Capital Goods

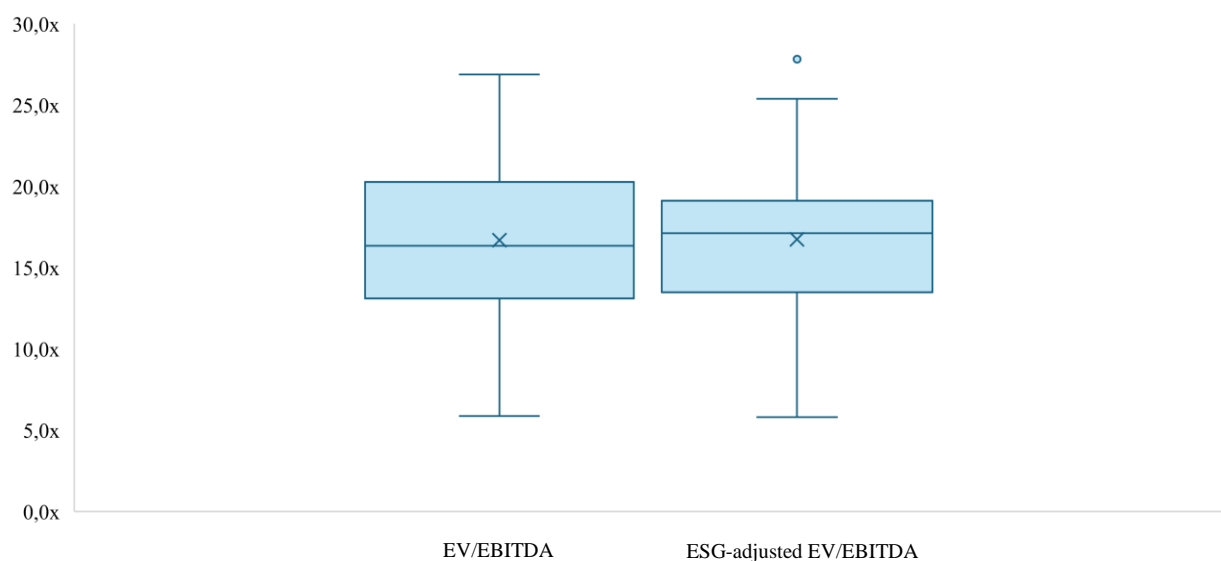


Figure 7.2.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Capital Goods

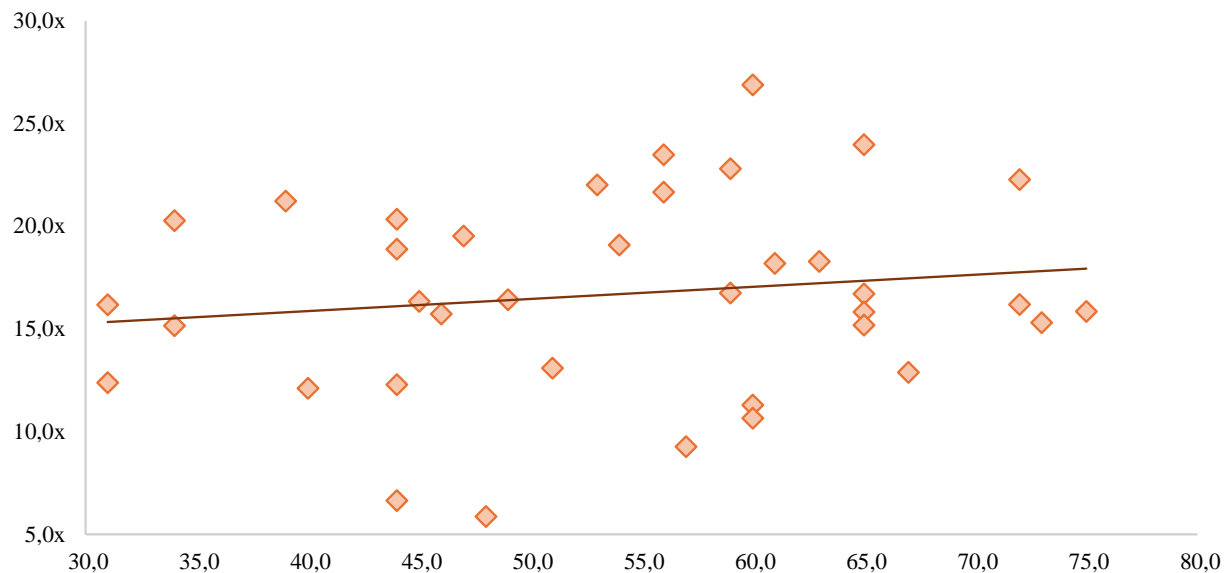


Figure 7.2.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Capital Goods

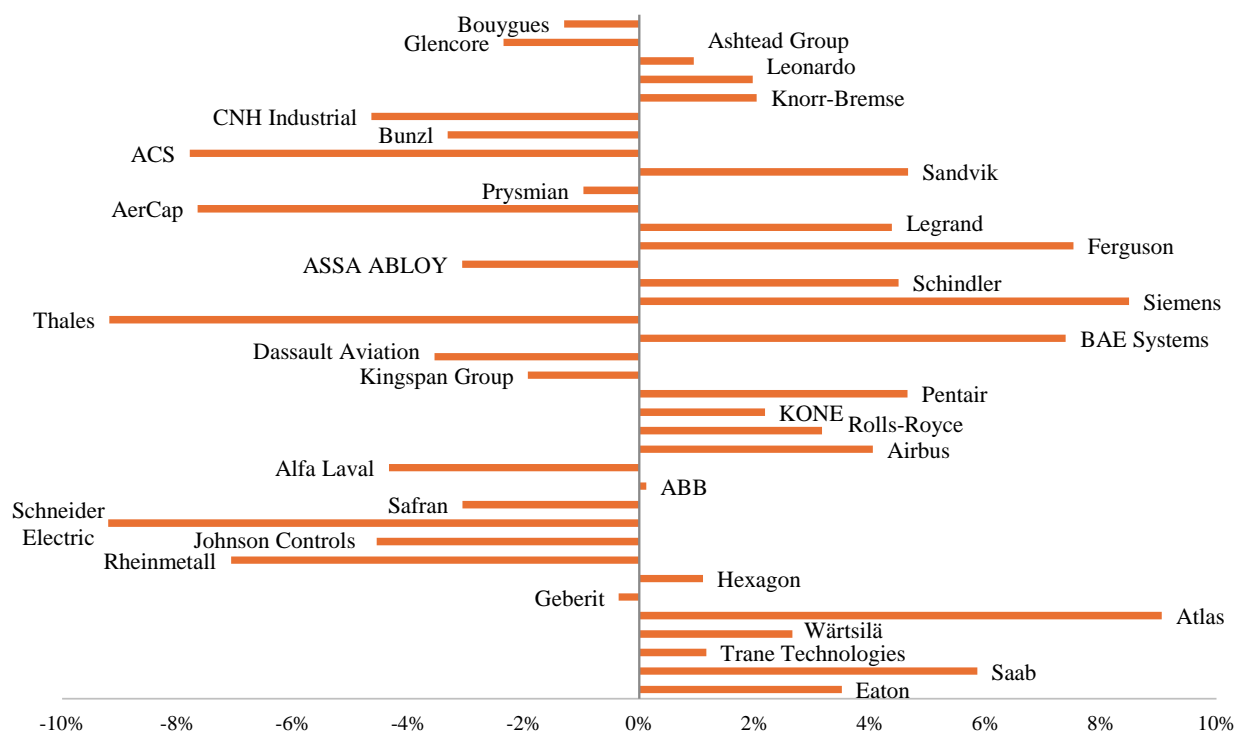


Figure 7.2.4: ESG premiums and discounts – Capital Goods

7.3 Communication services

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Infoma plc	United Kingdom	13,201.1	3,675.6	15,458.2	1,110.7	13.9x	39.0	(0.306)	0.246	12.9x
Publicis Groupe SA	France	25,265.3	14,802.0	26,673.3	2,504.0	10.7x	50.0	(0.086)	0.199	10.5x
Telefónica, SA	Spain	24,125.2	40,747.0	68,261.2	7,721.0	8.8x	75.0	0.414	0.171	9.5x
Swisscom AG	Switzerland	26,811.4	11,331.8	34,353.1	3,970.4	8.7x	64.0	0.194	0.168	8.9x
Vodafone Group plc	United Kingdom	22,337.2	36,717.0	71,992.4	8,387.0	8.6x	74.0	0.394	0.167	9.1x
Deutsche Telekom AG	Germany	111,768.8	114,794.0	282,726.8	39,276.0	7.2x	58.0	0.074	0.144	7.3x
Telenor ASA	Norway	14,839.2	6,908.5	22,623.6	2,221.7	10.2x	55.0	0.014	0.192	10.2x
Koninklijke KPN N.V.	Netherlands	13,607.5	5,473.0	19,659.5	2,223.0	8.8x	46.0	(0.166)	0.171	8.6x
BT Group plc	United Kingdom	14,869.4	24,346.1	39,978.9	7,558.9	5.3x	57.0	0.054	0.110	5.3x
Orange SA	France	26,050.1	44,122.0	62,616.1	13,124.0	4.8x	25.0	(0.586)	0.100	4.5x
Min		13,201.1	3,675.6	15,458.2	1,110.7	4.8x	25.0	(0.586)		4.5x
Max		111,768.8	114,794.0	282,726.8	39,276.0	13.9x	75.0	0.414		12.9x
Average		29,287.5	30,291.7	64,434.3	8,809.7	8.7x	54.3	-		8.7x
Median		23,231.2	19,574.0	37,166.0	5,764.7	8.7x	56.0	0.034		9.0x

Figure 7.3.1: Summary table of financial metrics and ESG adjustments – Communication Services

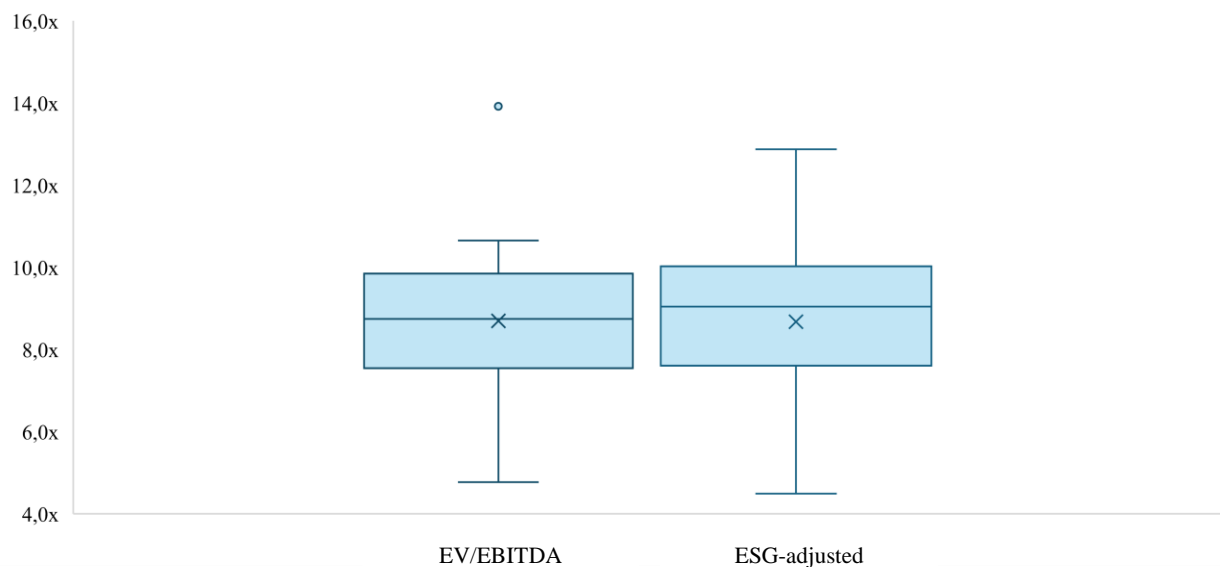


Figure 7.3.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Communication Services

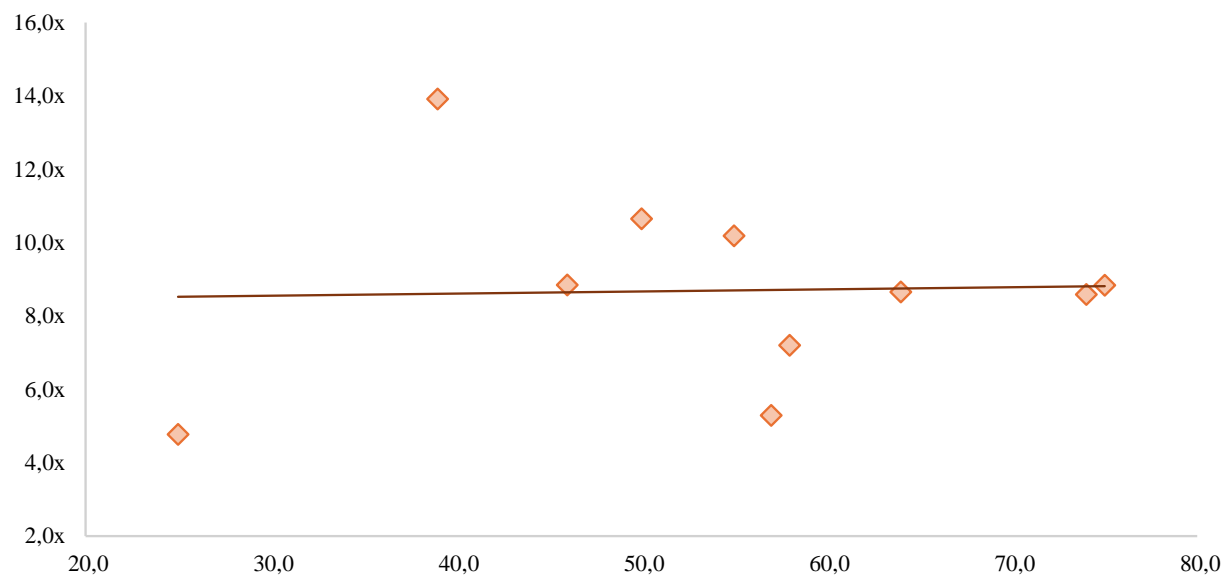


Figure 7.3.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Communication Services

7.4 Consumer Retail and Apparel

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
D'Ieteren Group SA	Belgium	10,422.3	7,983.6	11,068.5	481.1	23.0x	56.0	(0.056)	0.246	22.7x
Puig Brands SA	Spain	14,085.8	4,304.1	15,703.1	775.2	20.3x	48.0	(0.315)	0.223	18.8x
EssilorLuxottica SA	France	93,836.0	25,395.0	103,588.0	5,293.0	19.6x	66.0	0.266	0.217	20.7x
Prada S.p.A.	Italy	18,873.7	4,726.4	20,870.0	1,260.8	16.6x	64.0	0.202	0.191	17.2x
Industria de Diseño Textil SA	Spain	141,551.3	36,486.0	135,195.3	8,322.0	16.2x	62.0	0.137	0.188	16.7x
Moncler S.p.A.	Italy	16,035.1	2,984.2	15,885.0	983.3	16.2x	61.0	0.105	0.187	16.5x
Compagnie Financière Richemont SA	Switzerland	90,043.2	20,616.0	86,999.8	5,485.0	15.9x	74.0	0.524	0.184	17.4x
LVMH Moët Hennessy	France	365,939.9	86,153.0	395,332.9	25,270.0	15.6x	48.0	(0.315)	0.182	14.7x
H & M Hennes & Mauritz AB	Sweden	26,152.3	20,955.2	30,926.5	2,054.3	15.1x	46.0	(0.379)	0.177	14.0x
Pandora A/S	Denmark	11,851.0	3,903.8	13,546.5	1,104.6	12.3x	43.0	(0.476)	0.149	11.4x
NEXT plc	United Kingdom	10,860.1	6,428.9	15,094.9	1,263.6	11.9x	59.0	0.040	0.146	12.0x
Christian Dior SE	France	125,746.2	86,153.0	192,023.2	25,144.0	7.6x	66.0	0.266	0.100	7.8x
Min		10,422.3	2,984.2	11,068.5	481.1	7.6x	43.0	(0.476)		7.8x
Max		365,939.9	86,153.0	395,332.9	25,270.0	23.0x	74.0	0.524		22.7x
Average		77,116.4	25,507.4	86,352.8	6,453.1	15.8x	57.8	-		15.8x
Median		22,513.0	14,299.8	25,898.2	1,659.0	16.0x	60.0	0.073		16.6x

Figure 7.4.1: Summary table of financial metrics and ESG adjustments – Consumer Retail and Apparel

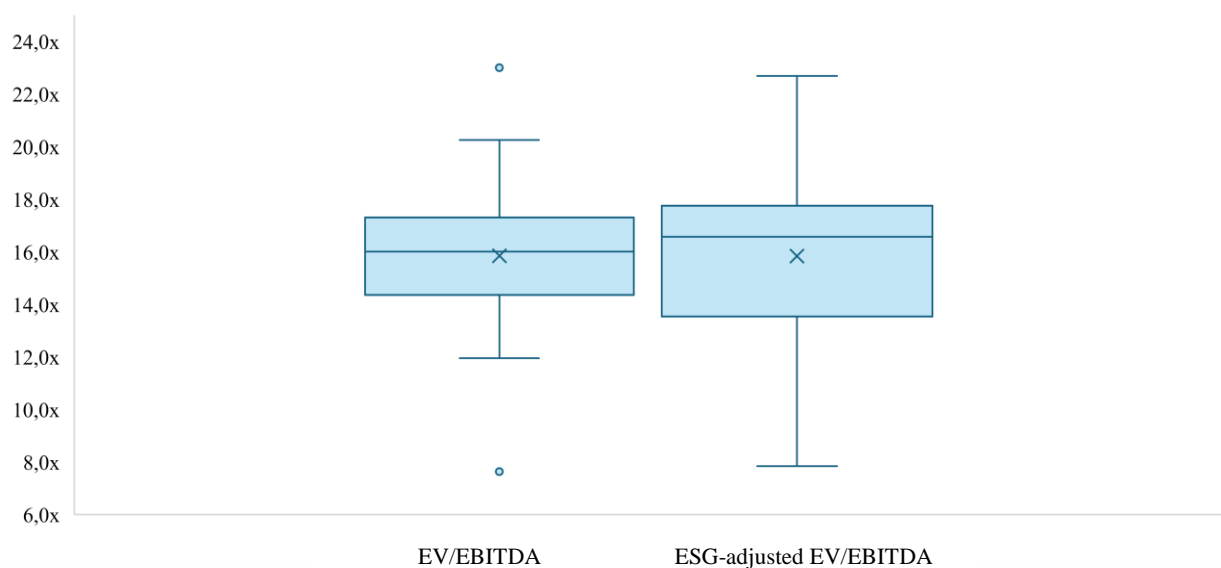


Figure 7.4.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Consumer Retail and Apparel

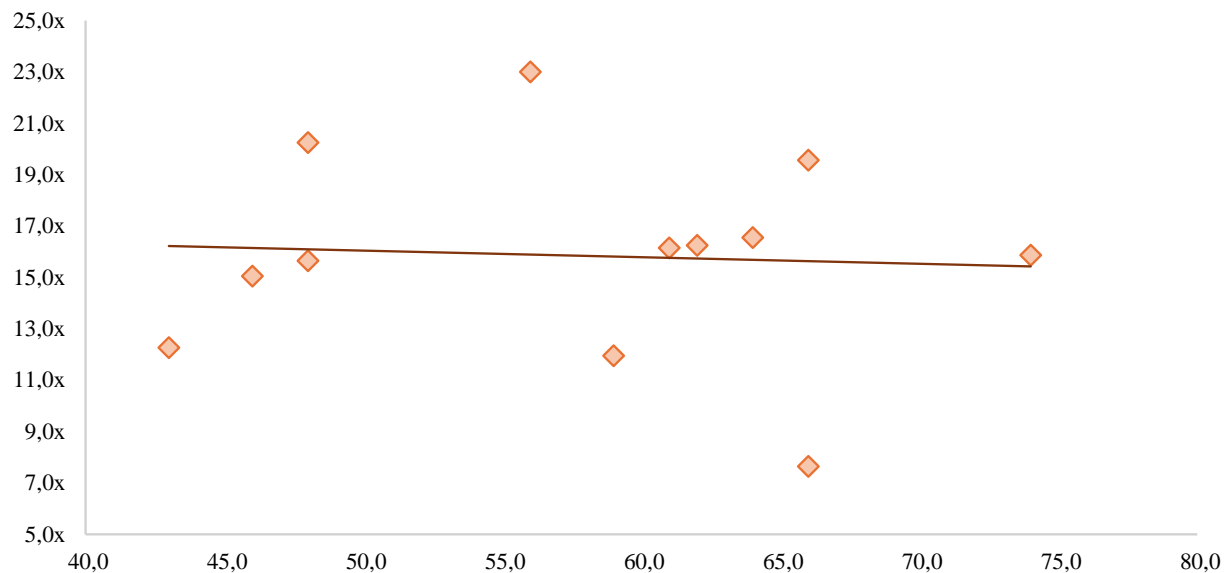


Figure 7.4.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Communication Services

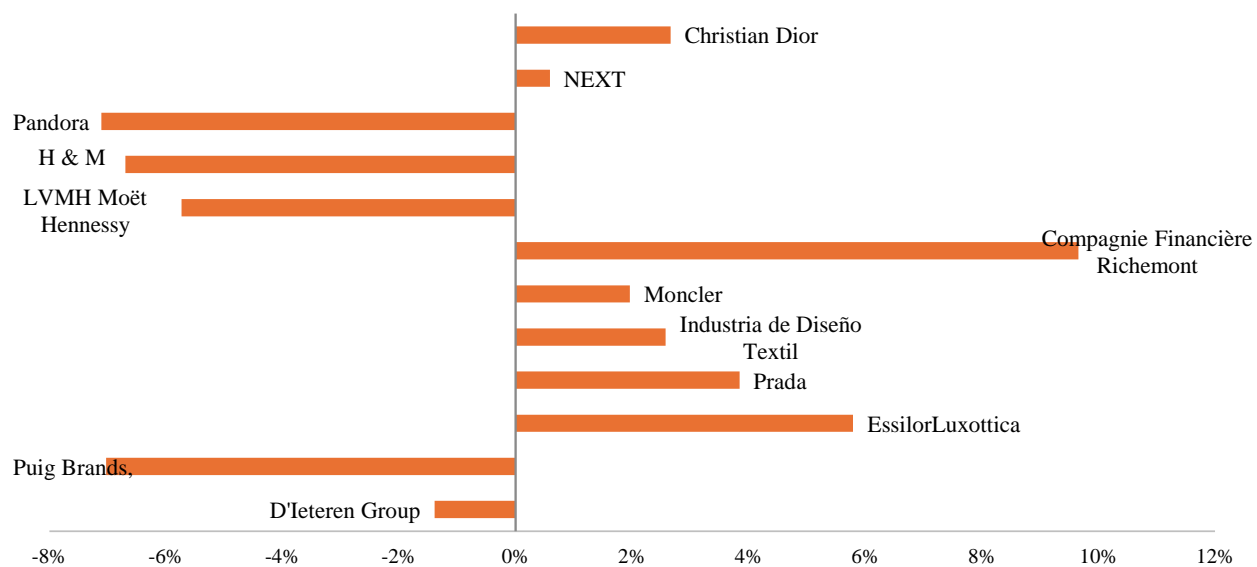


Figure 7.4.4: ESG premiums and discounts – Consumer Retail and Apparel

7.5 Consumer Services

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
InterContinental Hotels Group plc	United Kingdom	15,300.5	3,372.7	17,434.7	955.4	18.2x	58.0	0.187	0.246	19.1x
Compass Group plc	United Kingdom	44,304.3	38,259.3	49,173.7	2,871.3	17.1x	42.0	(0.347)	0.218	15.8x
Evolution AB (publ)	Sweden	20,393.4	1,870.5	19,478.7	1,241.8	15.7x	50.0	(0.080)	0.178	15.5x
Amadeus IT Group SA	Spain	28,672.3	5,626.2	31,284.1	2,095.0	14.9x	71.0	0.620	0.156	16.4x
Sodexo SA	France	12,529.0	23,157.0	16,595.0	1,257.0	13.2x	41.0	(0.380)	0.100	12.7x
Min		12,529.0	1,870.5	16,595.0	955.4	13.2x	41.0	(0.380)		12.7x
Max		44,304.3	38,259.3	49,173.7	2,871.3	18.2x	71.0	0.620		19.1x
Average		24,239.9	14,457.1	26,793.2	1,684.1	15.8x	52.4	-		15.9x
Median		20,393.4	5,626.2	19,478.7	1,257.0	15.7x	50.0	(0.080)		15.8x

Figure 7.5.1: Summary table of financial metrics and ESG adjustments – Consumer Services

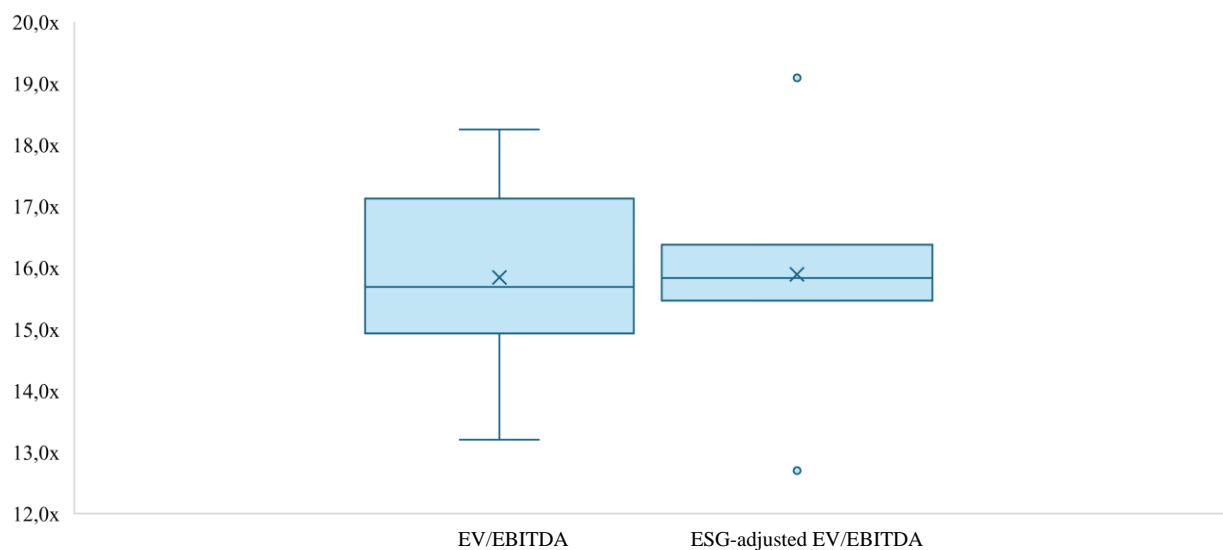


Figure 7.5.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Consumer Services

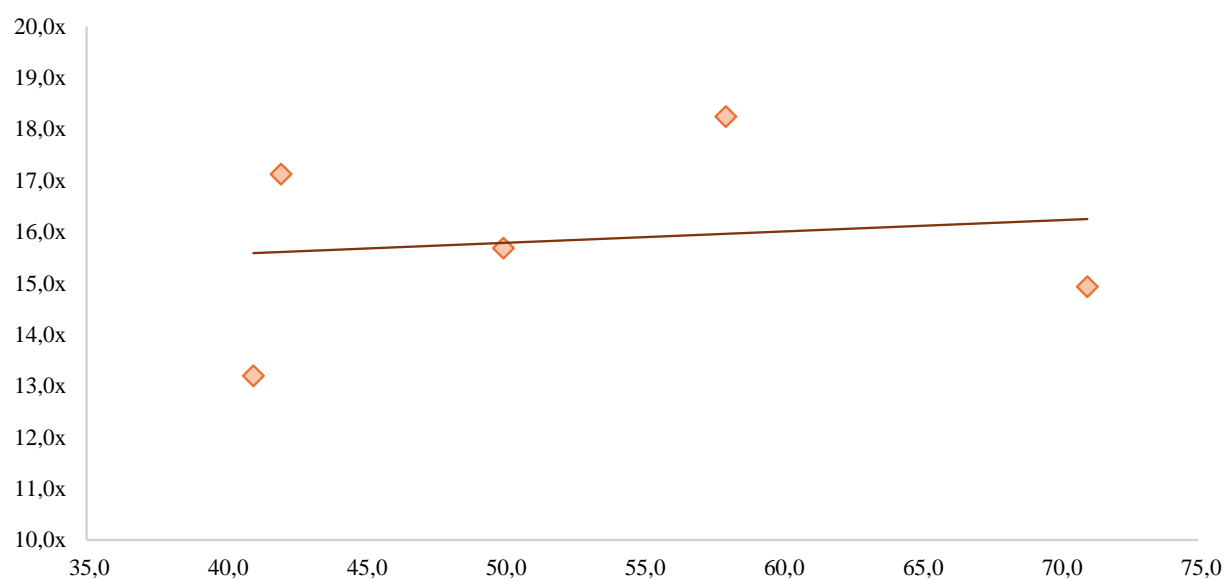


Figure 7.5.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Consumer Services

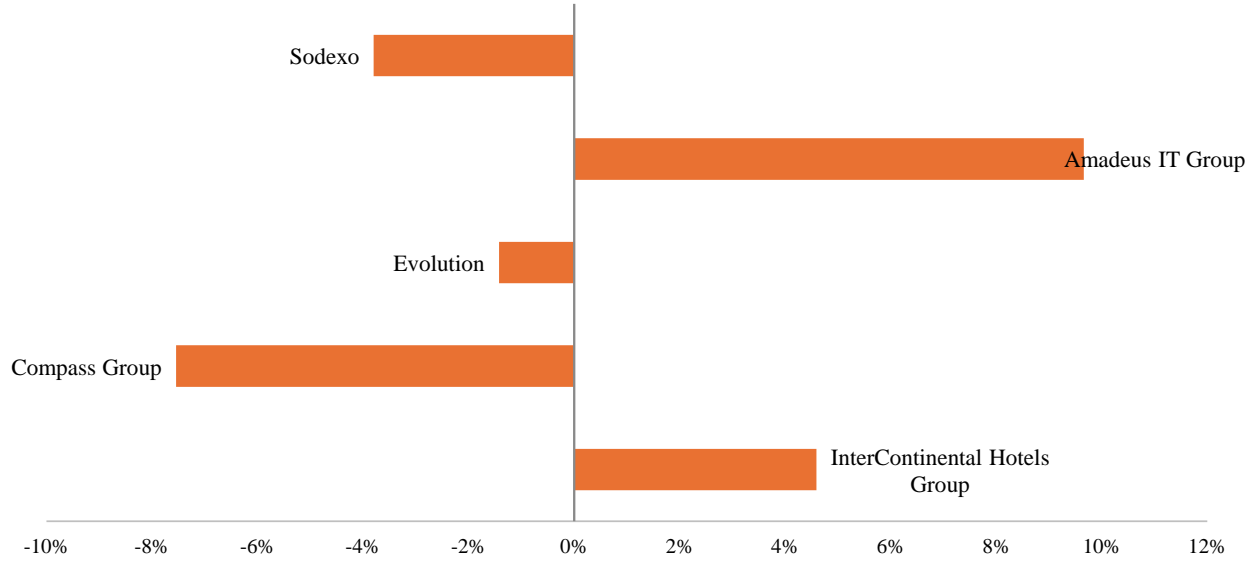


Figure 7.5.4: ESG premiums and discounts – Consumer Services

7.6 Consumer Staples

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Symrise AG	Germany	15,528.7	4,730.2	17,749.2	793.9	22.4x	49.0	(0.129)	0.246	21.6x
Davide Campari-Milano N.V.	Italy	11,609.1	2,914.2	13,481.5	679.8	19.8x	41.0	(0.364)	0.225	18.2x
BeiersdorfAG	Germany	32,341.8	9,447.0	29,941.8	1,558.0	19.2x	46.0	(0.217)	0.220	18.3x
Nestlé SA	Switzerland	257,206.7	99,916.0	309,104.2	19,506.6	15.8x	53.0	(0.011)	0.191	15.8x
Pernod Ricard SA	France	33,872.9	11,611.0	46,278.9	3,195.0	14.5x	68.0	0.430	0.178	15.6x
Diageo plc	United Kingdom	68,315.5	19,577.5	89,498.7	6,323.1	14.2x	66.0	0.371	0.175	15.1x
Unilever plc	United Kingdom	129,086.7	59,604.0	156,291.1	11,058.0	14.1x	51.0	(0.070)	0.175	14.0x
Kerry Group plc	Ireland	13,177.6	8,020.3	14,783.2	1,094.9	13.5x	39.0	(0.423)	0.169	12.5x
Heineken N.V.	Netherlands	53,212.1	30,362.0	71,806.1	5,703.0	12.6x	62.0	0.254	0.160	13.1x
Carlsberg A/S	Denmark	17,688.8	9,872.5	21,175.3	1,780.4	11.9x	50.0	(0.099)	0.153	11.7x
Anheuser-Busch InBev SA/NV	Belgium	115,280.6	55,348.9	188,292.5	16,903.9	11.1x	58.0	0.136	0.146	11.4x
Reckitt Benckiser Group plc	United Kingdom	36,498.8	16,832.6	45,004.2	4,164.7	10.8x	36.0	(0.511)	0.142	10.0x
Coca-Cola HBC AG	Switzerland	11,713.9	10,184.0	13,450.5	1,286.6	10.5x	53.0	(0.011)	0.139	10.4x
Danone SA	France	38,305.6	27,619.0	48,623.6	4,750.0	10.2x	70.0	0.489	0.137	10.9x
Associated British Foods plc	United Kingdom	22,235.3	23,253.9	25,299.0	2,672.7	9.5x	65.0	0.342	0.129	9.9x
Heineken Holding N.V.	Netherlands	21,569.1	30,362.0	50,091.1	5,717.0	8.8x	62.0	0.254	0.121	9.0x
Jerónimo Martins, SGPS, SA	Portugal	12,348.7	31,870.0	15,132.7	1,757.0	8.6x	37.0	(0.482)	0.120	8.1x
Koninklijke Ahold Delhaize N.V.	Netherlands	26,633.2	88,735.0	40,827.2	5,103.0	8.0x	45.0	(0.246)	0.113	7.8x
Tesco plc	United Kingdom	24,706.9	78,922.8	36,758.7	4,632.8	7.9x	47.0	(0.188)	0.112	7.8x
Imperial Brands plc	United Kingdom	19,944.5	21,284.8	32,974.9	4,338.4	7.6x	61.0	0.224	0.109	7.8x
British American Tobacco plc	United Kingdom	62,780.4	31,440.0	104,323.1	15,297.7	6.8x	62.0	0.254	0.100	7.0x
Min		11,609.1	2,914.2	13,450.5	679.8	6.8x	36.0	(0.511)		7.0x
Max		257,206.7	99,916.0	309,104.2	19,506.6	22.4x	70.0	0.489		21.6x
Average		48,764.6	31,995.6	65,280.4	5,634.1	12.3x	53.4	0.000		12.2x
Median		26,633.2	23,253.9	40,827.2	4,338.4	11.1x	53.0	(0.011)		11.4x

Figure 7.6.1: Summary table of financial metrics and ESG adjustments – Consumer Staples

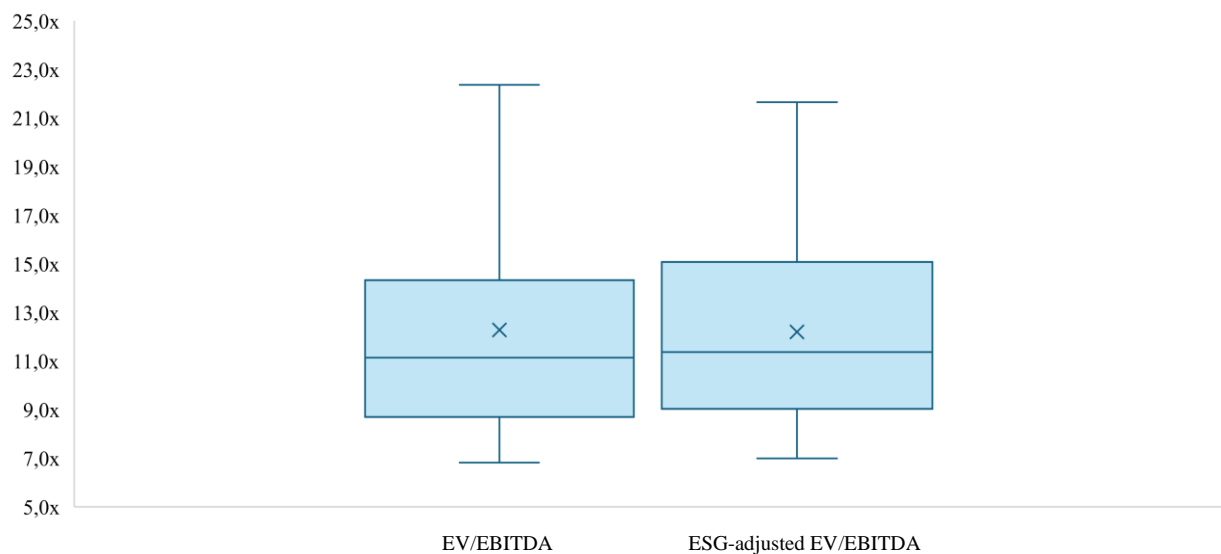


Figure 7.6.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Consumer staples

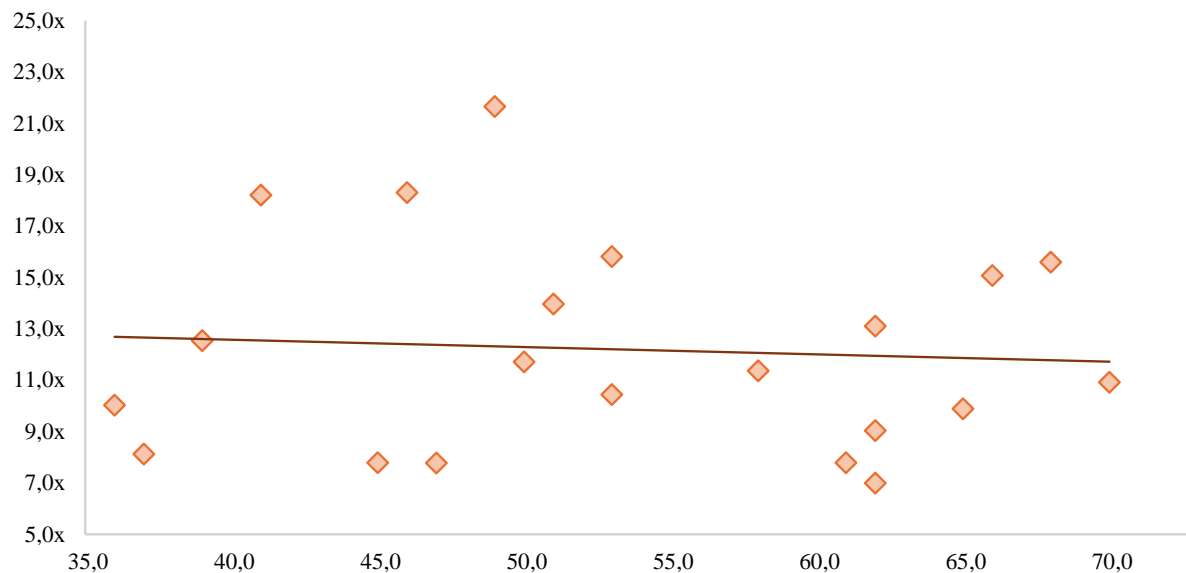


Figure 7.6.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Consumer Staples

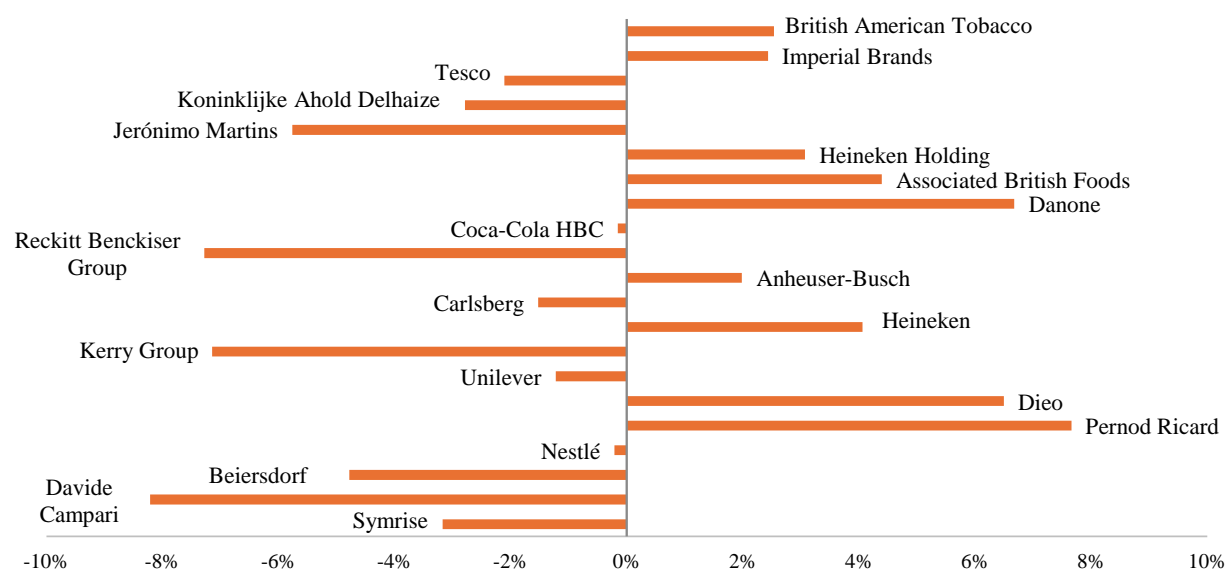


Figure 7.6.4: ESG premiums and discounts – Consumer Staples

7.7 Energy

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Shell plc	United Kingdom	208,132.2	280,052.6	247,314.2	39,540.6	6.3x	68.0	0.418	0.246	6.9x
Galp Energia, SGPS, SA	Portugal	14,518.5	20,698.0	18,737.5	3,670.0	5.1x	32.0	(0.505)	0.215	4.6x
TotalEnergies SE	France	147,669.8	197,054.3	172,957.5	39,143.0	4.4x	44.0	(0.197)	0.195	4.2x
Eni S.p.A.	Italy	44,633.3	89,468.0	65,728.3	17,058.0	3.9x	37.0	(0.377)	0.178	3.6x
BP plc	United Kingdom	90,652.0	186,380.1	134,898.7	35,239.8	3.8x	45.0	(0.172)	0.177	3.7x
Tenaris SA	Luxembourg	16,912.6	13,133.5	14,507.2	3,984.5	3.6x	49.0	(0.069)	0.171	3.6x
Repsol, SA	Spain	17,589.1	52,931.0	21,407.1	6,201.0	3.5x	60.0	0.213	0.165	3.6x
Equinor ASA	Norway	75,653.4	95,217.7	67,803.5	36,608.8	1.9x	71.0	0.495	0.111	2.0x
Orlen SA	Poland	16,649.6	78,996.8	19,640.0	11,658.0	1.7x	62.0	0.264	0.105	1.7x
Aker BP ASA	Norway	14,419.0	12,359.7	17,452.4	11,196.4	1.6x	49.0	(0.069)	0.100	1.5x
Min		14,419.0	12,359.7	14,507.2	3,670.0	1.6x	32.0	(0.505)		1.5x
Max		208,132.2	280,052.6	247,314.2	39,540.6	6.3x	71.0	0.495		6.9x
Average		64,683.0	102,629.2	78,044.6	20,430.0	3.6x	51.7	(0.000)		3.5x
Median		31,111.2	84,232.4	43,567.7	14,358.0	3.7x	49.0	(0.069)		3.6x

Figure 7.7.1: Summary table of financial metrics and ESG adjustments – Energy

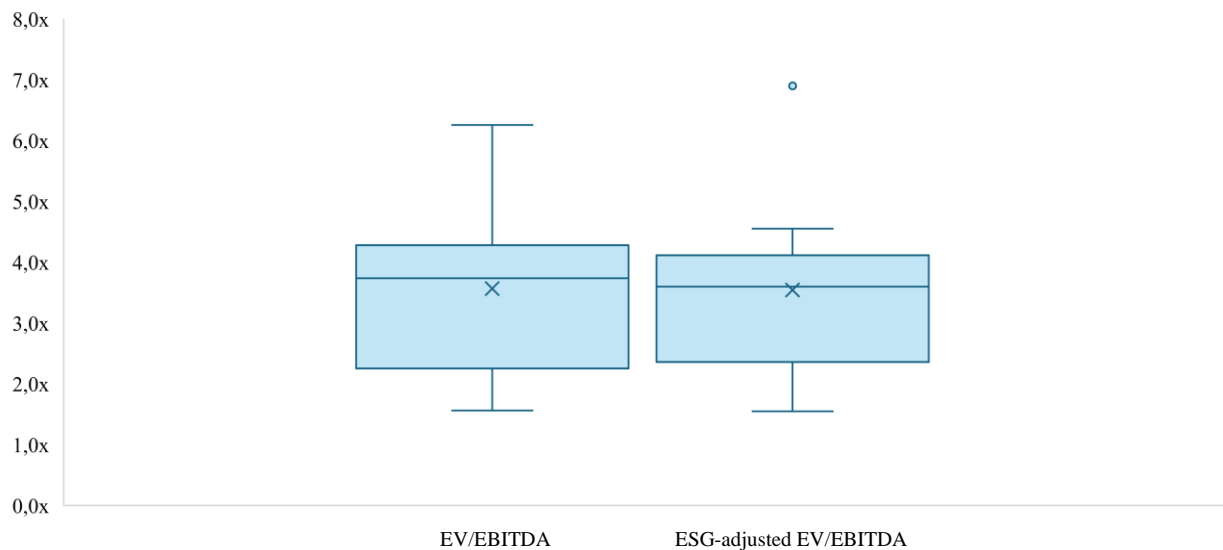


Figure 7.7.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Energy

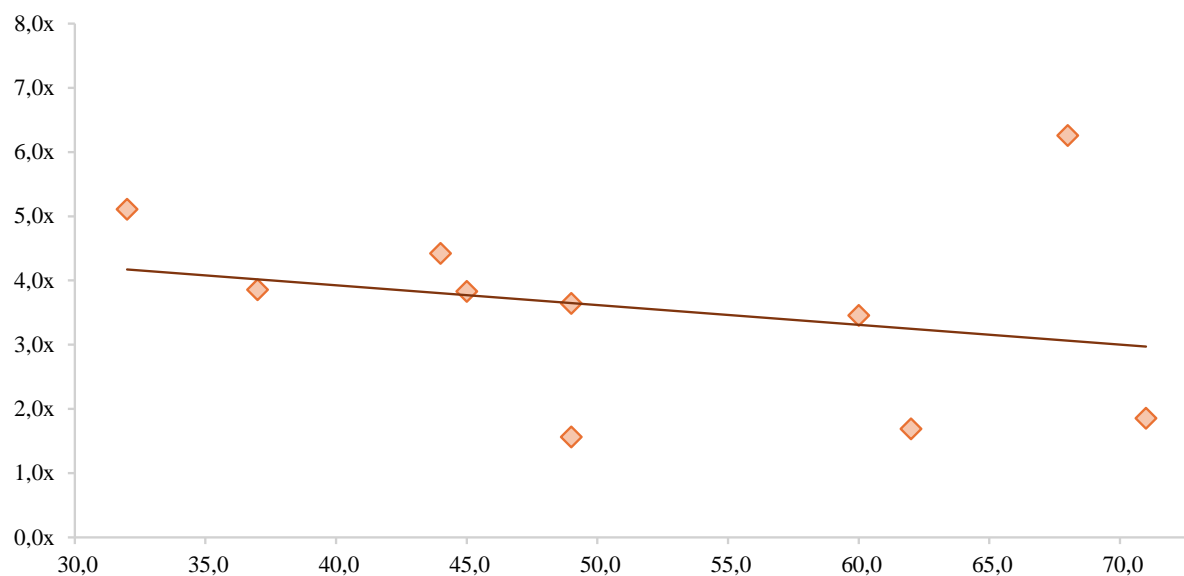


Figure 7.7.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Energy

7.8 Healthcare Equipment and Services

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Koninklijke Philips N.V.	Netherlands	22,839.6	18,140.0	28,689.6	876.0	32.8x	49.0	(0.035)	0.246	32.5x
Coloplast A/S	Denmark	25,472.8	3,422.0	28,640.4	1,050.2	27.3x	65.0	0.436	0.216	29.8x
Straumann Holding AG	Switzerland	18,844.9	2,591.2	18,941.5	726.1	26.1x	45.0	(0.152)	0.209	25.3x
Wolters Kluwer N.V.	Netherlands	35,551.8	5,584.0	38,165.8	1,700.0	22.5x	39.0	(0.329)	0.188	21.1x
Sonova Holding AG	Switzerland	17,813.9	3,726.8	19,164.1	859.4	22.3x	46.0	(0.123)	0.187	21.8x
Siemens Healthineers AG	Germany	61,301.4	21,868.0	73,302.4	3,392.0	21.6x	31.0	(0.564)	0.182	19.4x
STERIS plc	United States	20,786.6	4,763.1	23,760.0	1,256.9	18.9x	51.0	0.024	0.165	19.0x
Medtronic plc	Ireland	100,188.8	30,315.4	116,247.7	8,530.5	13.6x	53.0	0.083	0.130	13.8x
Smith & Nephew plc	United Kingdom	10,430.0	5,020.2	13,020.5	1,010.5	12.9x	57.0	0.201	0.125	13.2x
bioMérieux SA	France	10,817.5	3,674.7	10,983.9	857.8	12.8x	58.0	0.230	0.125	13.2x
Fresenius Medical Care AG	Germany	11,478.3	19,473.9	23,612.4	2,508.5	9.4x	58.0	0.230	0.100	9.6x
Min		10,430.0	2,591.2	10,983.9	726.1	9.4x	31.0	(0.6)		9.6x
Max		100,188.8	30,315.4	116,247.7	8,530.5	32.8x	65.0	0.4		32.5x
Average		30,502.3	10,779.9	35,866.2	2,069.8	20.0x	50.2	0.0		19.9x
Median		20,786.6	5,020.2	23,760.0	1,050.2	21.6x	51.0	0.0		19.4x

Figure 7.8.1: Summary table of financial metrics and ESG adjustments – Healthcare Equipment & Services

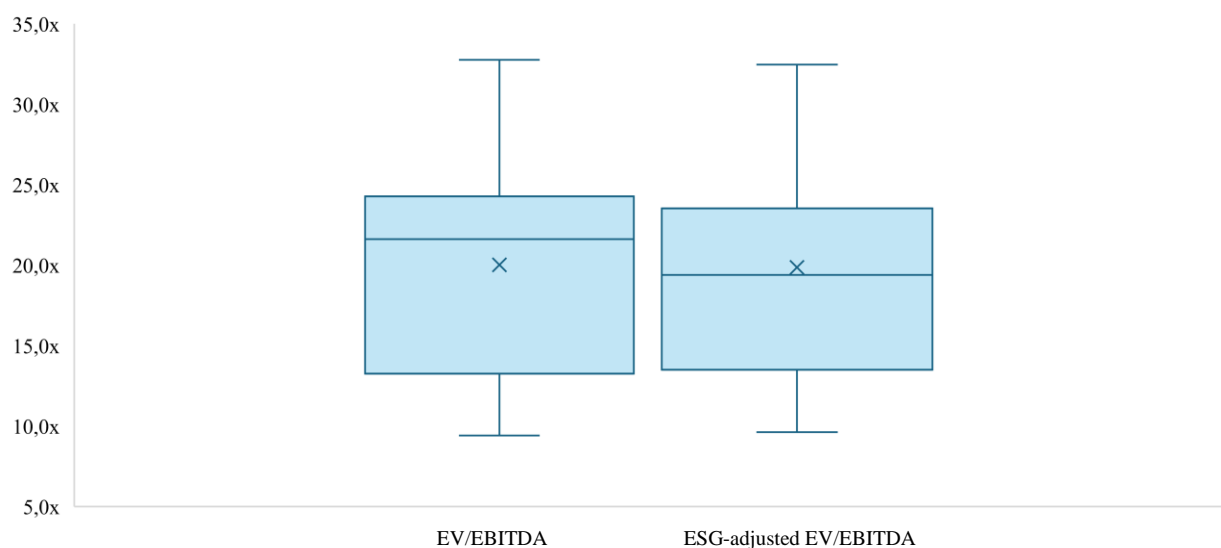


Figure 7.8.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Healthcare Equipment & Services

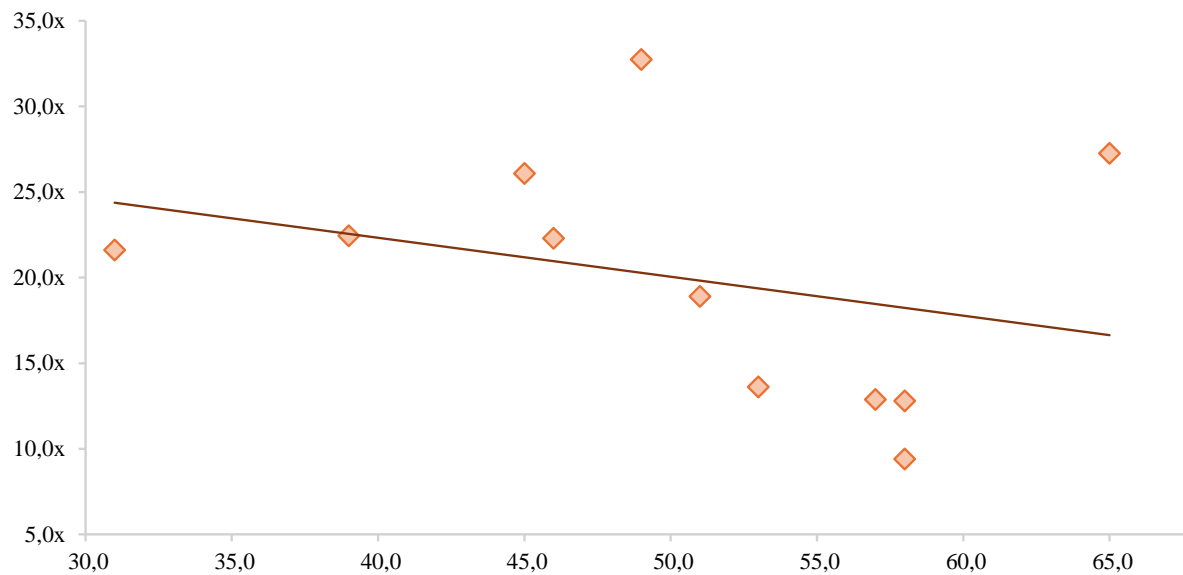


Figure 7.8.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Healthcare, Equipment & services

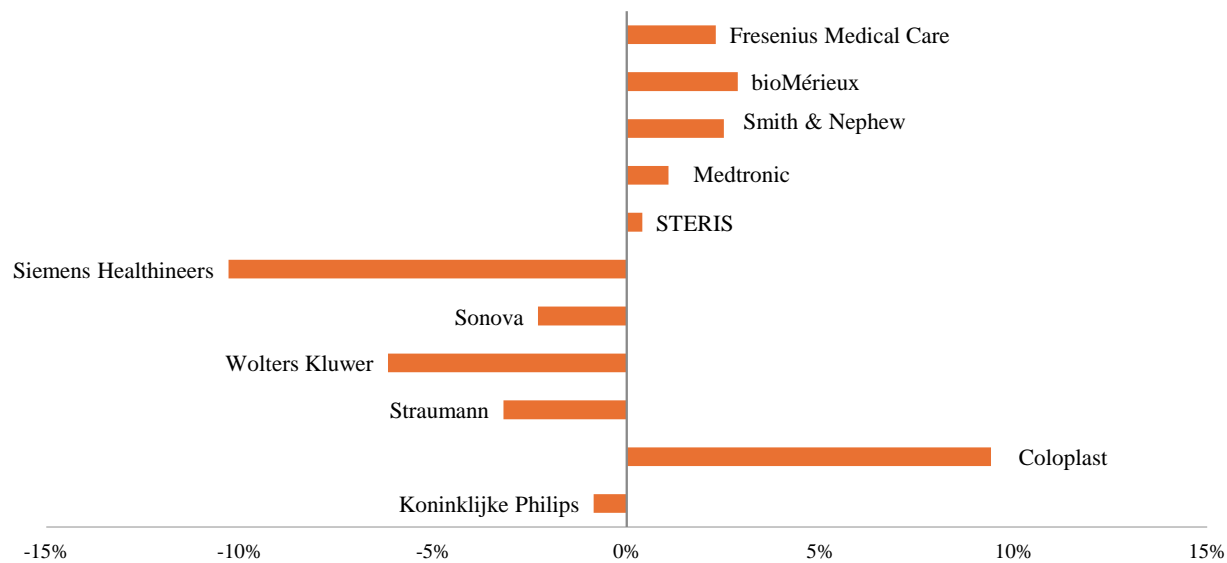


Figure 7.8.4: ESG premiums and discounts – Healthcare Equipment & Services

7.9 Healthcare, Pharmaceuticals, Biotechnology and Life Sciences

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Sartorius AG	Germany	15,562.9	3,312.1	20,746.8	776.6	26.7x	73.0	0.602	0.246	30.7x
UCB SA	Belgium	24,933.2	4,944.0	27,048.2	1,269.0	21.3x	45.0	(0.398)	0.213	19.5x
Lonza Group AG	Switzerland	37,034.1	7,216.7	38,614.8	2,057.5	18.8x	45.0	(0.398)	0.196	17.3x
ICON plc	Ireland	24,439.4	7,630.2	27,498.3	1,566.7	17.6x	61.0	0.173	0.188	18.1x
AstraZeneca plc	United Kingdom	227,562.3	44,130.6	252,664.1	14,647.8	17.2x	60.0	0.137	0.186	17.7x
Fresenius SE & Co. KGaA	Germany	16,576.1	22,457.0	30,734.1	1,841.0	16.7x	58.0	0.066	0.182	16.9x
Merck KGaA	Germany	74,694.8	20,820.0	81,564.8	5,120.0	15.9x	54.0	(0.077)	0.176	15.7x
Genmab A/S	Denmark	16,314.3	2,384.0	12,482.3	797.8	15.6x	51.0	(0.184)	0.174	15.1x
Novartis AG	Switzerland	199,107.3	43,074.0	215,632.4	17,559.2	12.3x	58.0	0.066	0.150	12.4x
Eurofins Scientific SE	Luxembourg	10,464.3	6,514.6	13,225.4	1,187.1	11.1x	60.0	0.137	0.141	11.4x
Roche Holding AG	Switzerland	202,461.9	63,083.8	227,653.0	22,474.1	10.1x	49.0	(0.255)	0.134	9.8x
Sanofi	France	112,373.0	43,312.0	122,399.0	12,199.5	10.0x	66.0	0.352	0.133	10.5x
GSK plc	United Kingdom	78,116.6	35,985.9	93,614.0	12,335.2	7.6x	50.0	(0.220)	0.114	7.4x
BayerAG	Germany	26,589.3	47,013.0	68,289.3	11,477.0	6.0x	49.0	(0.255)	0.100	5.8x
Min		10,464.3	2,384.0	12,482.3	776.6	6.0x	45.0	(0.4)		5.8x
Max		227,562.3	63,083.8	252,664.1	22,474.1	26.7x	73.0	0.6		30.7x
Average		76,159.2	25,134.1	88,011.9	7,522.0	14.8x	56.2	0.0		14.9x
Median		31,811.7	21,638.5	53,452.1	3,588.7	15.8x	58.0	0.1		15.4x

Figure 7.9.1: Summary table of financial metrics and ESG adjustments – Healthcare, Pharmaceuticals, Biotechnology and Life Sciences

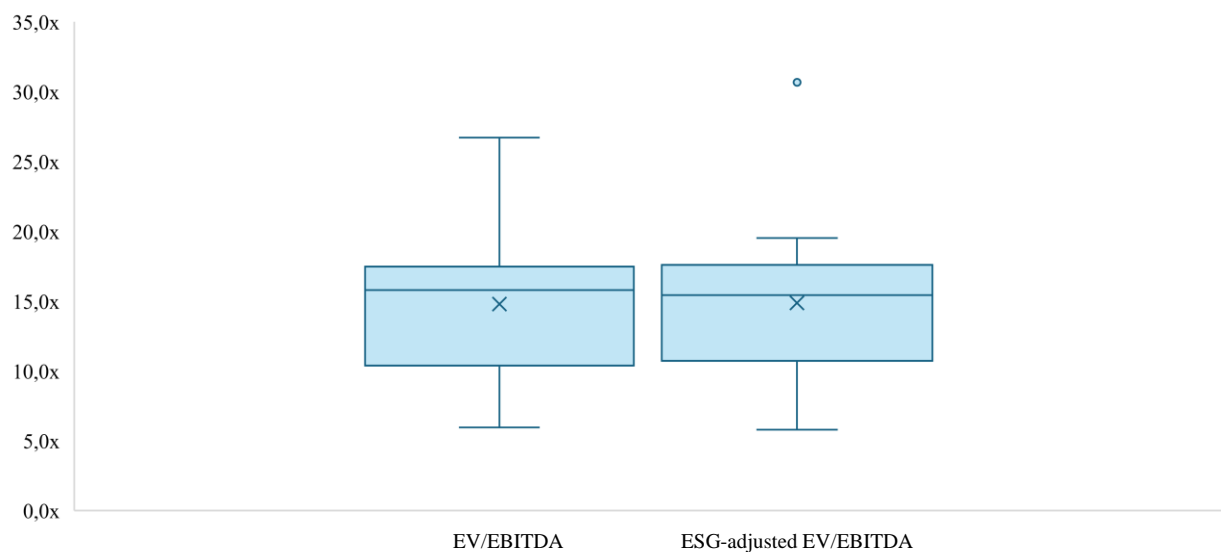


Figure 7.9.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Healthcare, Pharmaceuticals, Biotechnology and Life Sciences

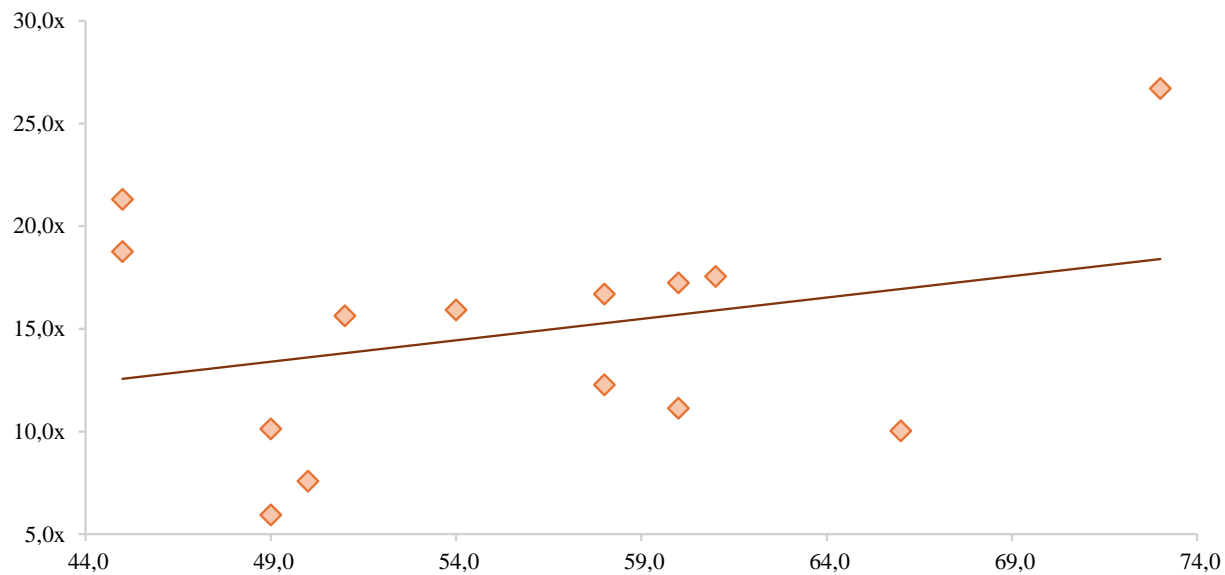


Figure 7.9.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Healthcare, Pharmaceuticals, Biotechnology and Life Sciences

7.10 Materials

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Sika AG	Switzerland	44,729.0	12,074.6	50,156.3	2,270.5	22.1x	63.0	0.117	0.246	22.7x
Linde plc	United Kingdom	195,169.9	30,366.2	210,898.7	11,310.0	18.6x	60.0	0.053	0.223	18.9x
UPM-Kymmene Oyj	Finland	17,786.4	10,313.0	20,681.4	1,376.0	15.0x	66.0	0.181	0.198	15.6x
L'Air Liquide SA	France	95,907.3	27,607.6	107,132.8	7,281.0	14.7x	77.0	0.415	0.196	15.9x
James Hardie Industries plc	Ireland	12,422.1	3,648.6	13,213.5	1,042.0	12.7x	49.0	(0.181)	0.181	12.3x
Ancor plc	Switzerland	13,438.7	12,770.8	20,301.3	1,732.4	11.7x	70.0	0.266	0.173	12.3x
Henkel AG & Co. KGaA	Germany	33,087.1	21,514.0	33,870.1	3,184.0	10.6x	44.0	(0.287)	0.165	10.1x
CRH plc	Ireland	49,915.2	32,492.5	60,741.1	5,726.4	10.6x	67.0	0.202	0.165	11.0x
Antofagasta plc	United Kingdom	24,169.7	5,721.8	27,707.3	2,618.8	10.6x	54.0	(0.074)	0.164	10.5x
Akzo Nobel N.V.	Netherlands	10,394.8	10,651.0	14,658.8	1,400.0	10.5x	46.0	(0.245)	0.164	10.1x
BASF SE	Germany	41,448.7	66,464.0	62,749.7	6,085.0	10.3x	56.0	(0.032)	0.162	10.3x
Holeim AG	Switzerland	46,700.6	29,018.2	55,807.4	6,338.9	8.8x	52.0	(0.117)	0.150	8.6x
Smurfit Kappa Group Plc	Ireland	11,054.4	11,272.0	13,908.4	1,895.0	7.3x	61.0	0.074	0.138	7.4x
Compagnie de Saint-Gobain SA	France	38,686.1	47,944.0	46,564.1	6,532.0	7.1x	70.0	0.266	0.137	7.4x
Heidelberg Materials AG	Germany	17,279.6	21,206.4	23,737.3	3,701.5	6.4x	54.0	(0.074)	0.131	6.4x
Rio Tinto Group	United Kingdom	105,990.6	48,890.9	110,978.0	17,599.1	6.3x	60.0	0.053	0.130	6.3x
Anglo American plc	United Kingdom	33,938.3	27,730.9	50,081.1	8,340.4	6.0x	66.0	0.181	0.127	6.1x
ArcelorMittal SA	Luxembourg	18,572.9	61,227.3	24,922.2	5,071.1	4.9x	40.0	(0.372)	0.118	4.7x
Norsk Hydro ASA	Norway	11,725.2	16,486.0	13,533.5	4,090.0	3.3x	30.0	(0.585)	0.104	3.1x
OMVAG	Austria	13,418.9	35,851.0	20,274.9	6,950.0	2.9x	65.0	0.160	0.100	3.0x
Min		10,394.8	3,648.6	13,213.5	1,042.0	2.9x	30.0	(0.6)		3.0x
Max		195,169.9	66,464.0	210,898.7	17,599.1	22.1x	77.0	0.4		22.7x
Average		41,791.8	26,662.5	49,095.9	5,227.2	10.0x	57.5	-		10.1x
Median		28,628.4	24,560.8	30,788.7	4,580.5	10.4x	60.0	0.1		10.1x

Figure 7.10.1: Summary table of financial metrics and ESG adjustments – Materials

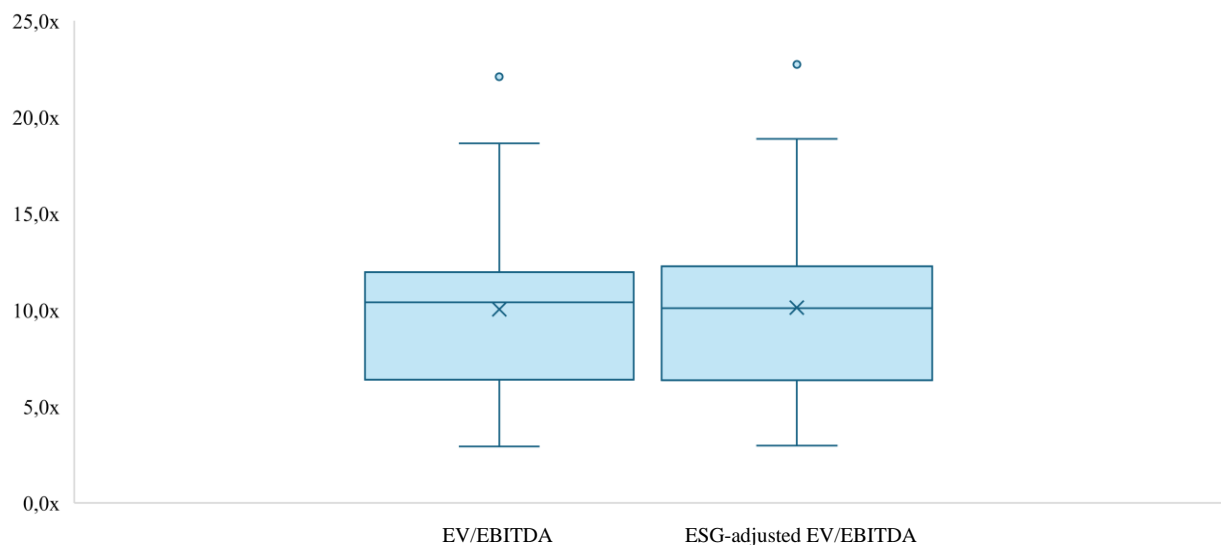


Figure 7.10.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Materials

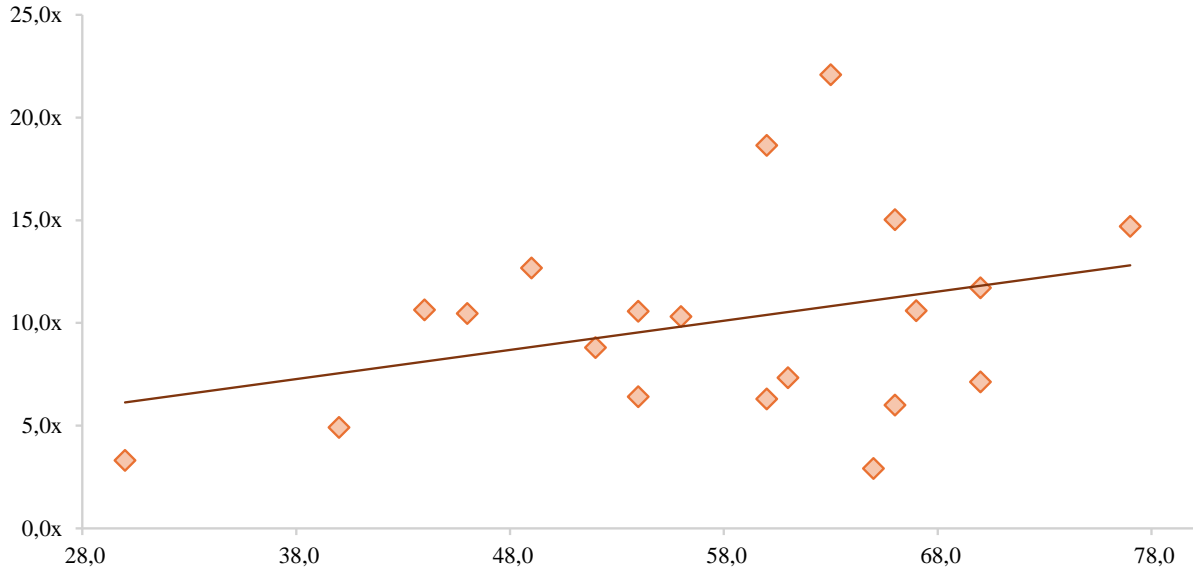


Figure 7.10.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Materials

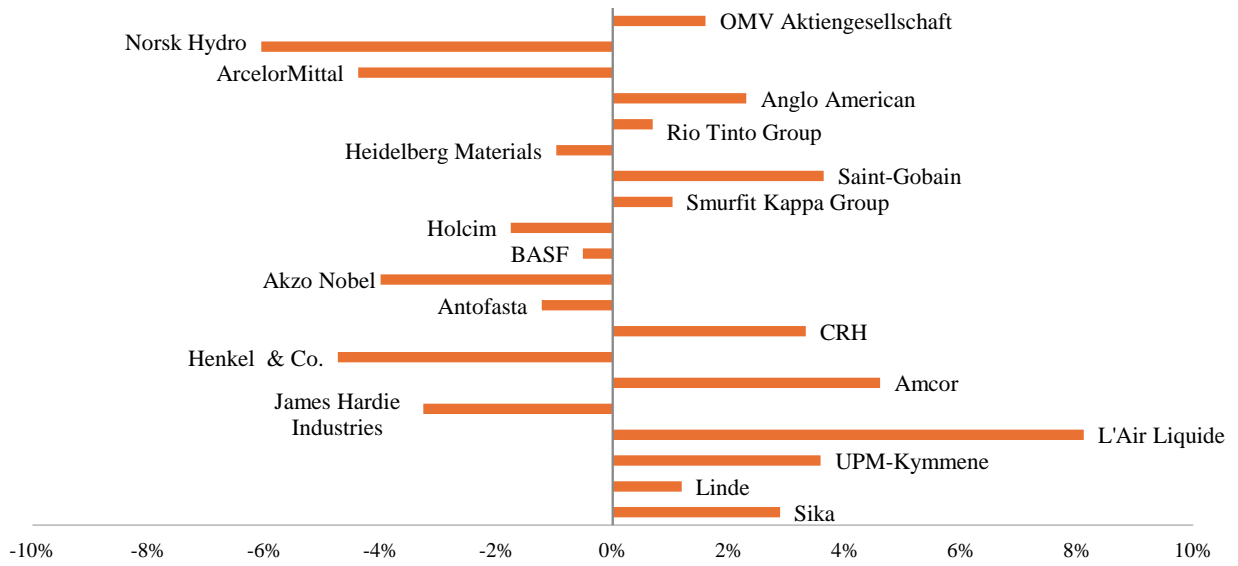


Figure 7.10.4: ESG premiums and discounts – Materials

7.11 Transportation

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
Kuehne + Nagel International AG	Switzerland	31,857.9	23,231.8	32,346.5	1,898.9	17.0x	54.0	(0.028)	0.246	16.9x
DSV A/S	Denmark	30,618.2	19,863.6	35,610.4	2,398.7	14.8x	65.0	0.365	0.221	16.0x
Hapag-LloydAG	Germany	28,631.4	16,570.5	28,187.3	2,092.9	13.5x	47.0	(0.278)	0.205	12.7x
Aena S.M.E., SA	Spain	27,180.0	5,254.5	32,911.3	2,973.2	11.1x	66.0	0.401	0.175	11.8x
Aeroports de Paris SA	France	11,873.3	5,495.0	20,671.3	1,888.0	10.9x	41.0	(0.492)	0.173	10.0x
Deutsche Post AG	Germany	45,163.5	81,091.0	63,464.5	7,615.0	8.3x	50.0	(0.171)	0.138	8.1x
Vinci SA	France	57,479.2	69,618.0	80,004.2	11,102.0	7.2x	60.0	0.187	0.122	7.4x
A.P. Møller - Mærsk A/S	Denmark	23,841.8	45,615.5	21,841.8	3,716.9	5.9x	41.0	(0.492)	0.102	5.6x
Ryanair Holdings plc	Ireland	19,325.8	13,443.8	17,959.4	3,120.2	5.8x	69.0	0.508	0.100	6.0x
Min		11,873.3	5,254.5	17,959.4	1,888.0	5.8x	41.0	(0.492)	-	5.6x
Max		57,479.2	81,091.0	80,004.2	11,102.0	17.0x	69.0	0.508	-	16.9x
Average		30,663.5	31,131.5	36,999.6	4,089.5	10.5x	54.8	-	-	10.5x
Median		28,631.4	19,863.6	32,346.5	2,973.2	10.9x	54.0	(0.028)	-	10.0x

Figure 7.11.1: Summary table of financial metrics and ESG adjustments – Transportation

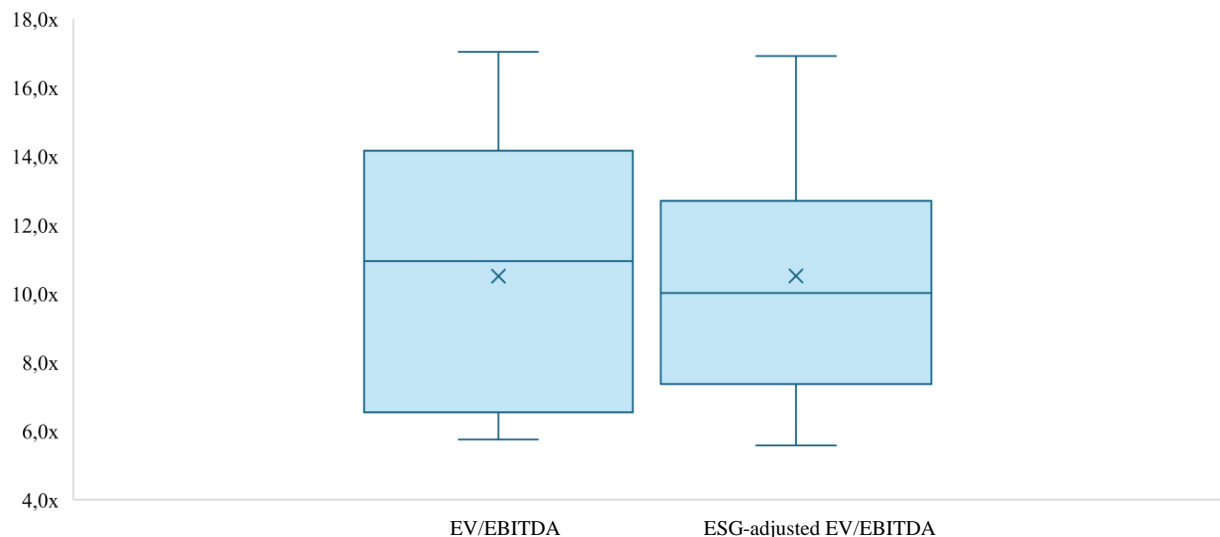


Figure 7.11.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Transportation

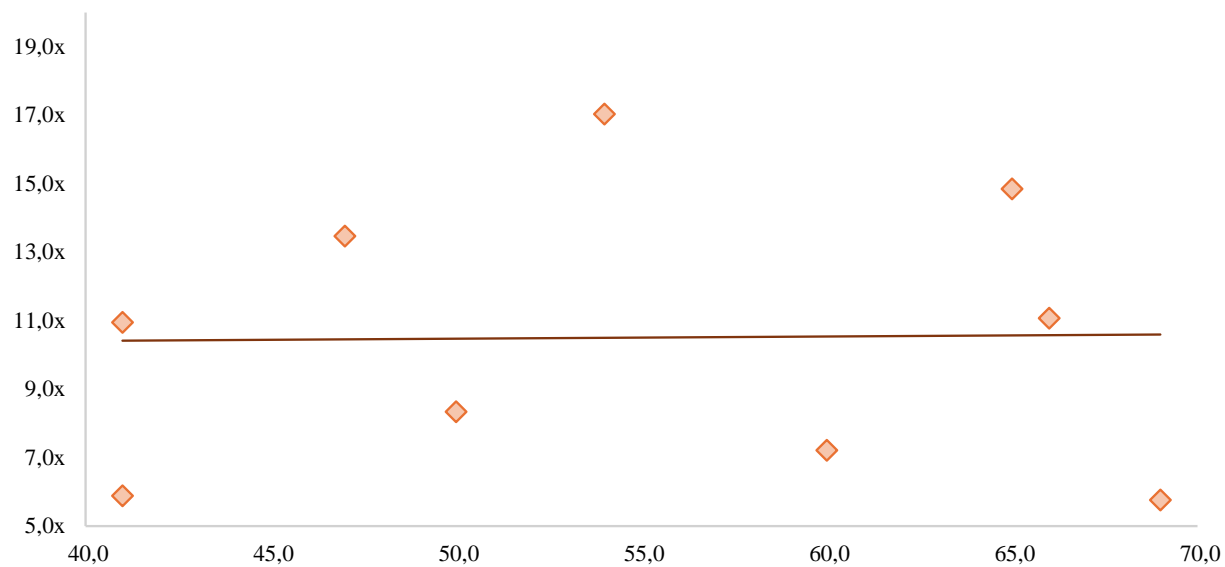


Figure 7.11.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Transportation

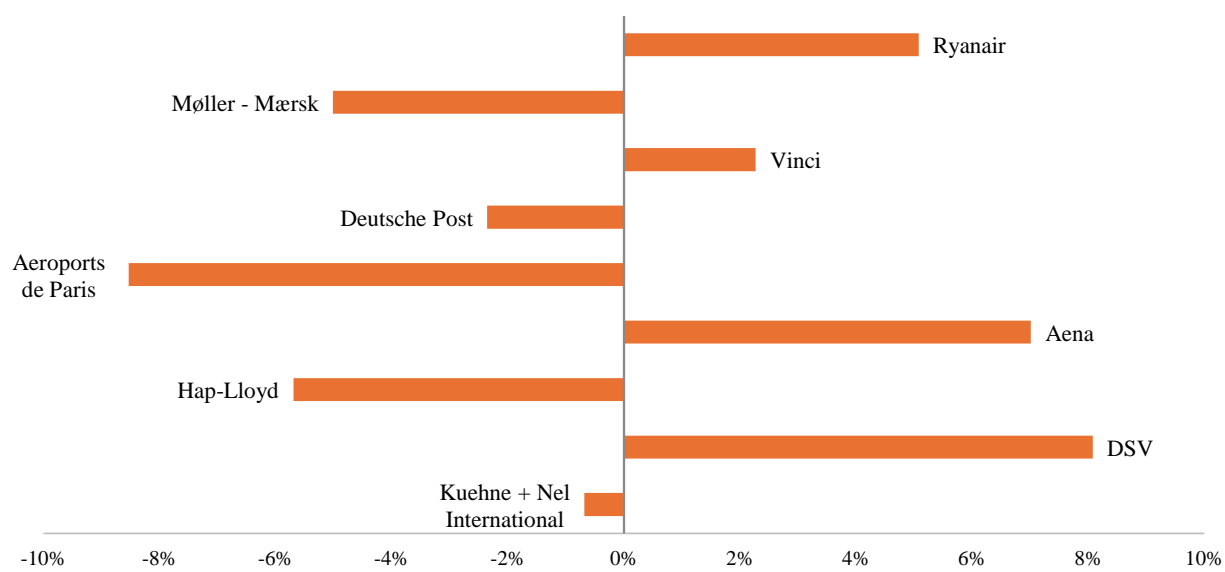


Figure 7.11.4: ESG premiums and discounts – Transportation

7.12 Utilities

Name	Country	Market Cap	Revenues	EV	EBITDA	EV/EBITDA	ESG score	Norm rating	α	ESG EV/EBITDA
E.ON SE	Germany	32,084.2	84,140.0	68,971.2	5,448.0	12.7x	64.0	0.234	0.246	13.4x
Snam S.p.A.	Italy	14,517.8	4,219.0	30,357.8	2,526.0	12.0x	41.0	(0.277)	0.237	11.2x
Terna S.p.A.	Italy	15,284.0	3,268.4	25,894.1	2,233.2	11.6x	71.0	0.389	0.230	12.6x
Endesa, SA	Spain	19,308.2	23,158.0	31,719.2	2,799.0	11.3x	66.0	0.278	0.226	12.0x
EDP - Energias de Portugal, SA	Portugal	15,389.5	15,477.6	40,536.0	3,603.7	11.2x	67.0	0.301	0.225	12.0x
National Grid plc	United Kingdom	38,084.6	23,237.5	90,230.9	8,516.5	10.6x	28.0	(0.566)	0.215	9.3x
EnBW Energie Baden-Württemberg AG	Germany	18,472.3	39,053.3	33,838.6	3,393.3	10.0x	58.0	0.101	0.205	10.2x
Ørsted A/S	Denmark	22,249.2	9,746.6	29,318.5	2,981.3	9.8x	51.0	(0.055)	0.202	9.7x
Iberdrola, SA	Spain	75,972.7	46,552.9	135,686.7	15,094.6	9.0x	49.0	(0.099)	0.188	8.8x
Enel SpA	Italy	66,708.5	85,900.0	148,699.5	18,116.0	8.2x	42.0	(0.255)	0.175	7.8x
Fortum Oyj	Finland	12,705.3	6,461.0	13,795.3	1,745.0	7.9x	42.0	(0.255)	0.170	7.6x
Veolia Environnement SA	France	21,225.1	45,351.0	41,181.1	5,309.0	7.8x	44.0	(0.211)	0.167	7.5x
SSE plc	United Kingdom	22,811.0	12,241.8	33,305.1	4,418.5	7.5x	70.0	0.367	0.163	8.0x
Naturgy Energy Group, SA	Spain	20,309.9	22,617.0	34,946.9	4,989.0	7.0x	47.0	(0.144)	0.153	6.9x
VERBUND AG	Austria	26,229.9	8,879.4	28,640.5	4,369.3	6.6x	44.0	(0.211)	0.145	6.4x
S.P.E.E.H. Hidroelectrica SA	Romania	11,154.0	2,299.7	9,806.9	1,567.4	6.3x	73.0	0.434	0.140	6.6x
CEZ, a. s.	Czech Republic	20,371.8	13,080.9	25,552.3	5,296.7	4.8x	58.0	0.101	0.112	4.9x
Engie SA	France	34,493.6	82,565.0	67,859.6	15,663.0	4.3x	62.0	0.189	0.102	4.4x
RWEAG	Germany	25,059.9	25,855.0	33,772.9	7,941.0	4.3x	39.0	(0.322)	0.100	4.1x
Min		11,154.0	2,299.7	9,806.9	1,567.4	4.3x	28.0	(0.566)		4.1x
Max		75,972.7	85,900.0	148,699.5	18,116.0	12.7x	73.0	0.434		13.4x
Average		26,970.1	29,163.4	48,637.5	6,105.8	8.6x	53.5	-		8.6x
Median		21,225.1	22,617.0	33,772.9	4,418.5	8.2x	51.0	(0.055)		8.0x
Dispersion						2.57				2.72

Figure 7.12.1: Summary table of financial metrics and ESG adjustments – Utilities

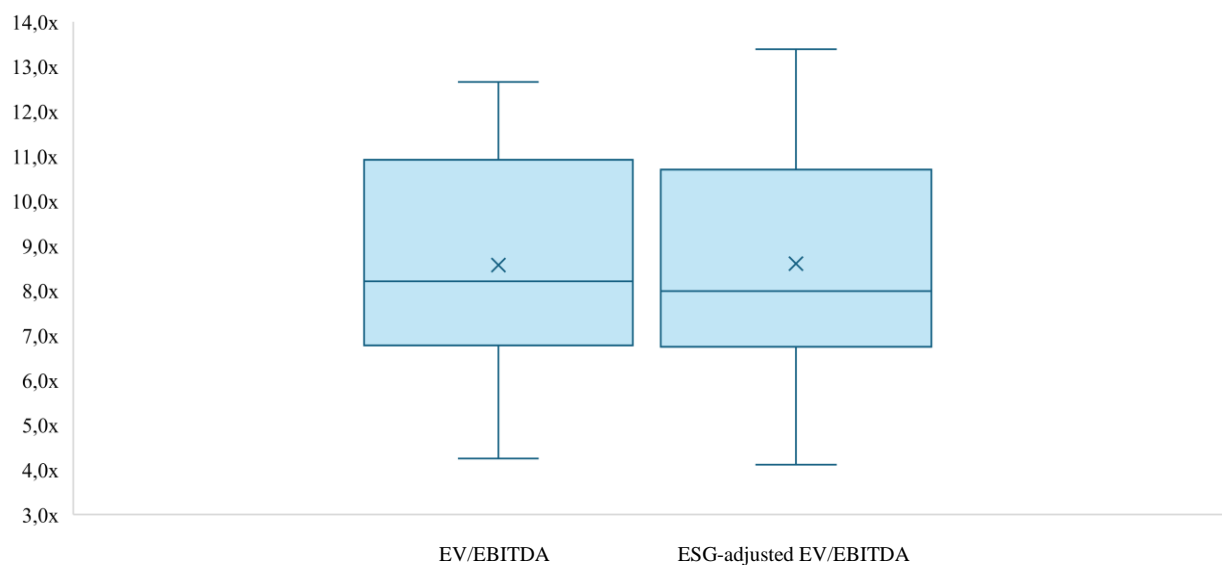


Figure 7.12.2: Box plot comparison of EV/EBITDA and ESG-adjusted EV/EBITDA Multiples – Utilities

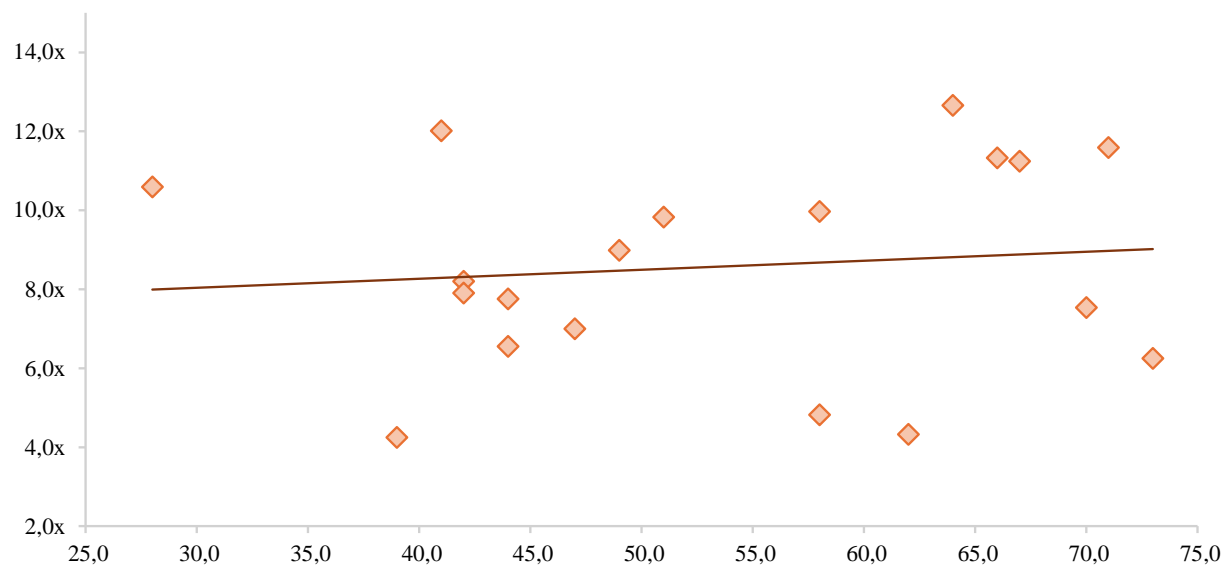


Figure 7.12.3: Correlation between baseline EV/EBITDA multiples and ESG scores – Utilities

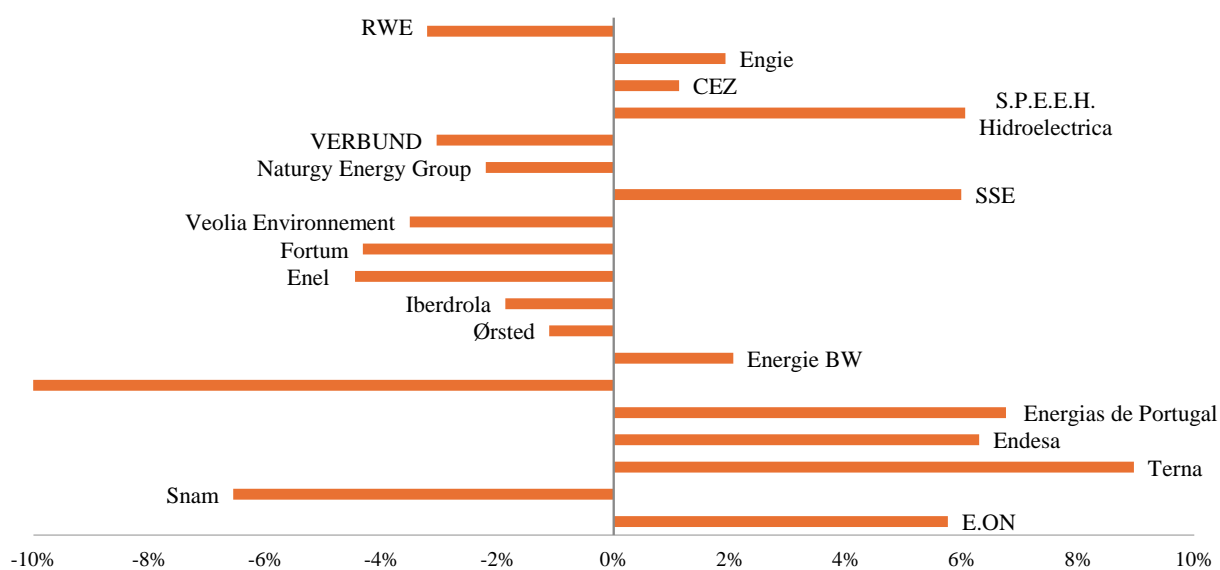


Figure 7.12.4: ESG premiums and discounts – Utilities